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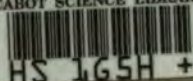
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Vol. 1. Part 2

MARCH, 1920

Number 2

BULLETIN

OF THE

NATIONAL RESEARCH COUNCIL

RESEARCH LABORATORIES IN INDUSTRIAL ESTAB-
LISHMENTS OF THE UNITED STATES OF AMERICA

Compiled by

ALFRED D. FLINN, Secretary, Engineering Foundation,

Assisted by

A. J. PORSKIEVIES, Member American Institute of Electrical Engineers
and

RUTH COBB, National Research Council

DEPARTMENT OF
BIOLOGICAL MEDICINE
HARVARD UNIVERSITY
CAMBRIDGE, MASS.

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Announcement Concerning Publications of the National Research Council

The Proceedings of the National Academy of Sciences
has been designated as the official organ of the National Research Council for the publication of accounts of research, committee and other reports, and minutes.

Subscription rate for the "Proceedings" is \$5 per year. Business address: Home Secretary, National Academy of Sciences, Smithsonian Institution, Washington, D. C.

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RESEARCH LABORATORIES IN INDUSTRIAL ESTABLISH-
MENTS OF THE UNITED STATES OF AMERICA

A CLASSIFIED LIST WITH SOME INFORMATION ABOUT STAFF, WORK
AND EQUIPMENT

Compiled by ALFRED D. FLINN, Secretary, Engineering Foundation, Assisted by A. J.
PORSKIEVIES, Member, American Institute of Electrical Engineers,
and RUTH COBB, National Research Council

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Herein are given the names of approximately three hundred laboratories in industrial establishments in the United States of America, which have stated in direct correspondence that they are engaged in research. Most of them devote but a portion of their effort to research, and a number are probably not research laboratories, under a strict definition of that word. Nevertheless, in this first publication of the lists, all laboratories have been included which have supplied information and which by a liberal interpretation do any research work. The 'Annual Chemical Directory of the United States,' published by Williams and Wilkins Company, Baltimore, Maryland, contains lists of laboratories in five classes: (1) Industrial, (2) Institutional, (3) Federal and State, (4) Municipal, (5) Commercial. This publication does not distinguish between research and other laboratories.

Research is sometimes differentiated into 'scientific' and 'industrial.' Scientific research comprises investigations directed toward the discovery of new truths for the sake of increasing human knowledge. Industrial research is the endeavor to learn how to apply scientific facts to the ser-

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vice of mankind. Many laboratories are engaged in both industrial research and industrial development. These two classes of investigation commonly merge so that no sharp boundary can be traced between them. Indeed, the term research is frequently applied to work which is nothing else than development of industrial processes, methods, equipment, production or by-products. For development, apparatus is often used of larger size than is common in physical and chemical laboratories; it is frequently of semi-commercial scale or even of full manufacturing size. Furthermore, in practice it frequently is difficult to keep clear the distinction between scientific and industrial research.

All information given was obtained directly by correspondence. By using second-hand information and published articles, the list of laboratories could have been extended somewhat. It was preferable that only original and unquestionably authentic statements should be used in the *Bulletin of the National Research Council*. Insofar as has been possible the phraseology of the original correspondence has been used.

No investigation has been made to ascertain the character of any laboratory listed, nor the quality of work done. Statements are based upon letters or other information supplied by the laboratories at first hand. Consequently, the compiler has accepted these statements, but does not vouch for their accuracy. He may have fallen into errors in extracting and interpreting the letters. Some laboratories gave full information; others meager. An endeavor has been made, especially in the latter cases, to utilize all the information that could be extracted from the letters.

Corrections and more information will be welcomed so that a succeeding edition of this bulletin may be better. For this purpose a special blank is provided. In case of error or omissions in any of the data given, the corresponding item should be filled in and the sheet returned to the Publication Office, National Research Council, 1201 Sixteenth St., Washington, D. C. Return sheets giving information concerning industrial research laboratories which are not included in this list will also be welcomed.

LIMITATIONS OF THE LIST

Laboratories connected with federal, state or municipal governments or with educational institutions were from the outset excluded from the inquiry as being in other fields, although frequently engaged upon investigations closely related to industrial research. The concerns which are not actually supporting laboratories in their own works have not been included, nor have the associations maintaining fellowships in certain educational institutions. They are to be encouraged, but this compilation is limited to the laboratories themselves, rather than organizations

supporting research. In tentative form the list of industrial research laboratories, containing then 350 names, was presented to the June, 1918, meeting of the American Society for Testing Materials, as a step in the process of gathering the information sought. This tentative list was obtained chiefly by letters to a few men having some knowledge of research in industry. Although incomplete, it has been useful in several ways besides aiding in the preparation of the list as now published. In search of information, letters were sent to 1350 establishments reported to have laboratories, asking for brief general statements, in the following form:

Staff (name of person in charge of research work; classes such as chemists, physicists, engineers, assistants; number of each).

Research Time (all, half, one-third, or other approximation).

Research Work (general kinds, with reference, if permissible, to special problems which would indicate the scope of the work which the laboratory can undertake). And—

Equipment (not a detailed list, but a summary indicating kinds and capacities in a general way and mentioning apparatus of unusual character or size).

Approximately 500 replies were received; 38 companies stated that they had no laboratories; 153 others that their laboratories did no real research; from the remaining replies, the alphabetical and classified lists have been compiled. Other companies are believed to have laboratories which should be in this list, but detailed information has not yet been received from them.

Knowing that some elaborate endeavors to collect information in this and other fields had fallen under their own weight, the present compiler decided to be content, in this first venture, with such data as could be readily obtained. It was believed that if these imperfect results demonstrated a need for better, cooperation in perfecting the compilation could be had subsequently. Furthermore, progress in industrial research would make another edition necessary in a relatively short time. In preparing this later edition, benefits would doubtless be received from the interest aroused in the subject by this first printing and from the experience gained.

Throughout the lists, an endeavor has been made to print each name exactly in the style used on the company's stationery, giving heed to spelling and abbreviations.

SYSTEMS OF CLASSIFICATION

For convenience of reference, the list of laboratories is given in four arrangements: 1. Alphabetical by the names of the companies. 2. Geographical by states. 3. A scientific and engineering classification, in

accordance with the nature of the work done or the general character of the industries. 4. A commercial classification, using trade designations in common use.

The alphabetical list carries all the information; the others, the names only. For the third list, no classification was found, and therefore one was devised with the assistance of members of the National Research Council, of the Engineering Foundation, and other persons interested in research work. It is based in part upon the classifications used for *Chemical Abstracts* and *Science Abstracts*. Likewise for the fourth list no suitable classification was ready to hand. Those of the United States Census, a few of the States, and some trade directories, were examined. These two classifications are printed separately from the list of laboratories, for convenience of reference or for other use.

In the Scientific and Engineering Classification, an attempt has been made to classify the laboratories, at least partially, from the view points of the research man, the scientist and the engineer. The Commercial Classification follows lines familiar to the manufacturer and the business man. In some cases the information obtained was so meager that classification was difficult or almost impossible. Corrections in these classification lists may also be made on the special blank provided, and will be welcomed for use in a succeeding edition.

Alphabetical List of Laboratories Connected with Industrial Establishments, giving the Name of the Director of Research and Some Information about Staff, Research Work and Equipment

1. **Abbé Engineering Company**, 220 Broadway, New York, N. Y. Laboratory at 230 Java St., Brooklyn, N. Y. Designs pulverizing and grinding machinery.

Research staff: H. F. Kleinfeldt and 2 men experienced in machinery.

Research work: Part time of 3 on the solution of problems which involve crushing, grinding, pulverizing, mixing, and sifting machinery.

Unusual equipment: Ball mills, pebble mills, rotary cutters, disintegrators, crushers, mixers, and sifters.

2. **Acheson Graphite Company**, Niagara Falls, N. Y. Manufactures graphite products, including dry-cell filler, paint pigment, stove polish, pencils, electrodes, crucibles, tubes, muffles, graphite and grease lubricants.

Research staff: A. M. Williamson and 5 or 6 chemists.

Research work: One-third time of 6, largely on a commercial scale, chemists being in charge of the manufacturing processes. Building and organization of a special laboratory for research in process.

3. **Aetna Explosives Company, Inc.**, 120 Broadway, New York, N. Y. Laboratory at Emporium, Pa.

Research staff: Fred Olsen and 1 assistant chief chemist, 8 assistant chemists, 2 laboratory assistants, 1 stenographer.

Research work: Full time of 13 on general research and on methods of manufacture of mineral acids and military and domestic explosives.

Unusual equipment: Semi-commercial scale apparatus for nitration; special equipment for analysis of explosives and for explosive testing.

4. **Aluminum Castings Co., The**, Cleveland, Ohio. Makes aluminum, brass and bronze castings.

Research staff: Zay Jeffries, 1 organizing engineer, about 10 chemists, 10 engineers, 1 specialist each in metallography, motor-testing and physical testing; necessary assistants.

Research work: Large part time of 40 to 50 on new alloys, especially aluminum, and aluminum bronze and brass; special casting processes and study of characteristics of products produced by them.

Unusual equipment: Internal combustion motor laboratory well equipped. Prepared to test apparatus requiring accurate energy measurements, such as gears. Dynamometers of 400, 200 and 150 horsepower; 50,000- and 10,000-pound tensile testing machines, Brinell hardness machine, White-Souther fatigue testing machine; special machine for testing bearings, Erickson cup testing machine; Cambridge Instrument Company impact testing machine; apparatus for determination of thermo-critical points, photo-micrographic outfit; apparatus for coefficients of thermal expansion and heat conductivity; small electric furnaces, up to 1800 degrees C.

5. **American Agricultural Chemical Company, The**. Agricultural Service Bureau, 92 State St., Boston, Mass. Chemical laboratory at Carteret, N. J.

Research staff: H. J. Wheeler, 9 agronomists and chemists, superintendent of experiment farm, 2 expert photographers and a clerical staff.

Research work: Study of requirements of soils where fertilizers have not been used; study of citrus fruits and other crops in Florida in connection with unusual types of soil; experiments with fertilizers in Wisconsin and Minnesota.

6. American Beet Sugar Company, Oxnard, Cal.

Research staff: H. E. Zitkowski and 2 agriculturists, 4 chemists and 2 engineers.

Research work: One-half time of 9 on agricultural problems of crop production, seed treatment to increase vitality, rotation, fertilization, etc.; increase of efficiency of processes, to reduce sugar losses, improve quality of product, develop by-products; recovery of nitrogen and potash.

Unusual equipment: Diffusion battery of 24 one cubic foot capacity cells; Steffens molasses desugarizing plant, capacity 100 to 200 pounds molasses per hour, with mill, cooler, filtering apparatus, refrigerating machine, and experimental lime kiln; Dorr thickener, 14 feet diameter, 8 feet high, two compartments together with 4- x 2-foot Oliver continuous filters, for increasing filtration efficiency; experimental retort for destructive distillation of liquids, such as Steffens waste waters, with object of devising methods for recovery of nitrogen and potash (can handle 200 pounds waste water with a 50 percent solid content per hour).

7. American Brass Company, The, Waterbury, Conn. Chemical, metallographic and metallurgical laboratory at Waterbury; physical and electrical testing laboratory at Ansonia.

Research staff: William H. Bassett and 3 metallurgists, 2 chemists, 1 physicist and metallographer, 1 metallographer, 2 metallurgical engineers, 1 testing engineer and necessary assistants.

Research work: One-third time of 11 on nature and effect of impurities in copper and its alloys; effects of mechanical working, heat treatment, corrosion and conditions of exposure.

Unusual equipment: Waterbury laboratory equipped for inorganic chemical analysis and assaying; metallographic equipment includes electrical furnaces and pyrometric apparatus for study of heat treatment of non-ferrous metals and alloys; Adam Hilger, Quartz "D" spectroscopy of high sensitiveness; facilities for production of special alloys, corrosion and other special tests. At Ansonia are 200,000-pound Olsen, 100,000-pound Riehle and smaller testing machines, covering physical testing of all materials down to very fine wire; fatigue and friction testing apparatus; electrical apparatus for accurate resistance and conductivity tests.

8. American Can Company, 120 Broadway, New York, N. Y. Laboratory at 447 West 14th St., New York, N. Y.

Research staff: Wm. S. Sellars and 1 assistant chemist, 2 analytical and research chemists, 1 analyst and laboratory assistant and 1 laboratory assistant.

Research work: One-half time of 6 on co-operative work with packers of food products in investigating chemical changes taking place in food

products and their influence upon the preservation of the food, its quality, and its wholesomeness. Manufacturing operations, including study of fluxes, white metal alloys, coals, oils and other materials.

Unusual equipment: Carbon dioxide expansion apparatus, permitting solution for volumetric analyses in the absence of oxygen. McIntosh photo-micrographic apparatus; special vulcanizing equipment, grinding and polishing apparatus; special apparatus for analysis of tin plate and solder for tin content; apparatus for investigating tin cans and sealing them; can testers; vacuum pumps; vacuum pots; incubators.

9. American Cotton Oil and Associated Cos., 65 Broadway, New York, N. Y. Research Department, 225 W. 18th St., Chicago, Ill.

Research staff: V. H. Gottschalk, 4 senior chemists, 3 junior chemists, 2 chemical engineers and 2 helpers.

Research work: Full time of 11, and one-half time of 1, on theoretical and industrial applications in connection with vegetable oils, their manufactured products, and soaps.

Unusual equipment: Miniature plant for experimental work on treating oils and fats.

10. American Cyanamid Company, 511 Fifth Avenue, New York, N. Y. Has three plants and a laboratory at each but research and development work are being centralized at plant nearest New York.

Research staff: W. S. Landis, 3 skilled chemists and several assistants, as a minimum. Usually includes 10 or 15 skilled men being trained for operating positions in new processes.

Research work: Full time of staff on fertilizers, nitrogen fixation, phosphates, potash, ammonia compounds and derivatives. Much of the work done in the experimental plants and laboratories is development, rather than true research.

Unusual equipment: Apparatus is of commercial size; frequently a complete small commercial plant is leased for experimental work. Laboratory equipment is provided anew for each large scale investigation.

11. American Leather Research Laboratory, 80 South St., New York, N. Y.

Research staff: George L. Terrasse, 1 chemist, 1 assistant and 1 stenographer.

Research work: Full time of 4 on problems connected with leather manufacture.

12. American Optical Company, Southbridge, Mass.

Research staff: C. H. Kerr, 2 physicists, 1 astronomer, 1 general chemist, 1 physical chemist, and 5 assistants.

Research work: Full time of 11 on metallurgical research in non-ferrous metals, especially on ability of metal and alloys to stand repeated workings. Spectral transmission of glasses, for example, glasses to reflect or absorb infra red. Optical designing in general, especially designing of scientifically correct ophthalmic lenses; also optical instrument designing. Abrasive material for grinding and polishing glass. Fusing together glasses of different types. Adhesives. Glass strength investigations.

Unusual equipment: Optical measuring apparatus for transmission in the ultra-violet, visible and infra red; Zeiss metallographic outfit; strength of materials testing apparatus.

13. American Radio and Research Corporation, Medford, Mass.

Research staff: V. Bush, 1 engineer manager and 5 assistants.

Research work: Full time of 7 on phenomena at radio frequencies, and other matters intimately connected with radio telegraphy and telephony.

Unusual equipment: Apparatus for measurements and research at high frequency, such as arcs, oscillating bulbs, generators and bridges.

14. American Research Fund, Atlanta, Ga.

Research staff: E. S. Rankin and 1 analytical chemist.

Research work: Full time of 2 on study of reduction of alcohol in medicinal extracts and preserving fluids.

15. American Rolling Mill Co., The, Middletown, Ohio. Specializes in commercially pure iron and sheets for electrical purposes.

Research staff: W. J. Beck, 1 chief chemist, 1 electrical engineer, 2 chemists, 1 metallurgist and necessary assistants.

Research work: Full time of 6 on metallurgical problems, corrosion of iron and steel, physical properties, heat treating of soft steels, etc. Some of the work is development rather than true research.

Unusual equipment: Metallurgical apparatus. Equipment for all chemical analyses in connection with steel plants, including hydrogen, oxygen and nitrogen gases.

16. American Sheet and Tin Plate Co., 210 Semple St., Pittsburgh, Pa.

Research staff: R. E. Zimmerman, 9 chemical engineers, 2 chemists, 1 physicist, 1 metallurgist.

Research work: Full time of 14 on chemical engineering problems relating to the manufacture of sheet steel, tin plate, and galvanized sheets; metallurgy, metallography and pyrometry as applied to these manufacturing processes.

17. American Sugar Refining Company, The, 117 Wall St., New York, N. Y. Service Division.

Research staff: A. V. Fuller, 2 chemists and 1 assistant.

Research work: One-half time of 4 on adaptability of various sugar cane products to special purposes; causes of failure in manufacture of sugar products and their remedies, and development of new sugar food products.

Unusual equipment: A trade candy kitchen in conjunction with the laboratory.

American Synthetic Dyes, Inc. See Butterworth-Judson Corporation.

18. American Vanadium Company, Bridgeville, Pa.

Research staff: B. D. Saklatwalla, 1 electrochemist, 1 metallurgical engineer, 1 metallographer and necessary assistants.

Research work: Three-fourths time of 4 on development of vanadium steels, other alloy steels, vanadium alloys, and new processes for extraction of vanadium from different minerals.

Unusual equipment: Physical testing, chemical, electrochemical and metallographic apparatus.

- 19. American Window Glass Co.,** Factory No. 1, Arnold, Pa.
Research staff: L. P. Forman, 4 chemists and 2 ceramists.
Research work: One-third time of 7 on new developments in glass industry, and ceramic work.
Unusual equipment: Pyrometric apparatus; high and low temperature electric furnaces.
- 20. American Writing Paper Co.,** Holyoke, Mass. Chemical research laboratory.
Research staff: R. E. Rindfusz and 7 chemists.
Research work: Full time of 8 on testing new fibers to determine possible commercial value; special paper problems.
Unusual equipment: 2 small model heaters, 3 small model boilers, a machine for testing tub sizing materials to determine their value in paper-making. 66-inch combination Fourdrinier and cylinder paper machine with full equipment for experimental purposes only.
- 21. American Zinc, Lead and Smelting Company,** 3759 West Pine Boulevard, St. Louis, Mo.
Research staff: Edward Schramm, 1 analytical chemist, 1 physical chemist, 1 mechanic and laboratory assistant.
Research work: Full time of 4 on conditions for roasting zinc ores, condensation of zinc, fundamental reactions in zinc smelting, methods for determining cadmium in brass.
Unusual equipment: High temperature furnaces.
- 22. Amoskeag Manufacturing Company,** Manchester, N. H. Textile mills.
Research staff: William K. Robbins, 3 chemists and 1 laboratory helper.
Research work: Small part time of 4 on waste recovery, dye, bleaching, sizing and testing problems. Semi-commercial scale experiments in plant.
Unusual equipment: Steam bath for dye tests, exposure boards for light and weather tests, cloth and yarn breaking machines.
- 23. Anaconda Copper Mining Co.,** Anaconda, Mont.
Research staff: F. F. Frick, 9 assistants and 10 to 20 non-technical assistants.
Research work: Full time of 20 to 30 on problems connected with the industry.
- 24. Ansco Company,** Binghamton, N. Y. Manufactures photographic equipment and supplies.
Research staff: Alfred B. Hitchins and 5 trained men.
Research work: Full time of 6 on photographic work.
Unusual equipment: For photographic emulsions, spectroscopic work, spectro-photography, photometry and photo-micrography, testing of dyes and color filters, polariscopic and refractometric work; high temperature ovens. Experimental laboratory for motion picture work.
- 25. Arbuckle Brothers,** Old Slip & Water St., P. O. Box 780, New York, N. Y. Sugar refiners, and manufacturers of flavoring extracts and spices.
Research staff: A. Hugh Bryan.
Research work: Small part of time on problems connected with the industry.

26. Arlington Mills, Lawrence, Mass. Textile mills.

Research staff: R. P. Iddings, 3 chemists and 3 assistants.

Research work: Full time of 1 on problems in manufacture of textiles.

27. Armour Glue Works, 31st Place & Benson St., Chicago, Ill. Laboratory serves also Armour Soap Works, Armour Ammonia Works, Armour Curled Hair Works, and Armour Sandpaper Works.

Research staff: J. R. Powell, 6 chemists, 6 laboratory assistants and 4 helpers.

Research work: Full time of 1 and part time of 2 on investigation of some of the plant processes. Work is principally analytical, for plant control.

28. Art in Buttons, Incorporated, Rochester, N. Y.

Research staff: F. W. Ross and 10 assistants.

Research work: Full time of 11 on problems concerning particular kind of button manufacture.

Unusual equipment: Temperature humidity controlled room; apparatus for strength of materials, elasticity, hardness, density and viscosity. Experimental machine shop for developing machinery peculiar to button manufacture.

29. Associated Factory Mutual Fire Insurance Companies, Inspection Department, 31 Milk St., Boston, Mass.

Research staff: Edw. A. Barrier, 2 chemists and 5 to 7 engineers.

Research work: One-sixth to one-fourth time of 9 on fire-protection engineering problems.

Unusual equipment: Apparatus for chemical, hydraulic and mechanical tests and investigations of fire-protection devices.

30. Atlantic Refining Company, The, 3144 Passyunk Avenue, Philadelphia, Pa. Manufactures petroleum products.

Research staff: T. G. Delbridge, 5 chemical engineers, 9 chemists, 1 physicist and 18 assistants. Mechanical and electrical engineering staffs collaborate with laboratory.

Research work: Three-fourths time of 34 on manufacturing methods of petroleum refinery, including study of manufacturing equipment and of equipment for testing.

Unusual equipment: A laboratory-scale petroleum refinery, together with complete equipment for study of petroleum products; large-scale manufacturing apparatus in the plant is at disposal of laboratory staff.

31. Atlas Powder Co., Wilmington, Del. Manufactures explosives; maintains three laboratories for research.

Research staff: M. C. Burt, Reynolds, Pa.; G. C. Given, Stamford, Conn.; F. Bonnet, Jr., Landing, N. J., and 35 chemists.

Research work: Full time of 38 on explosives of all kinds, caps, electric detonators, leather cloth, lacquers and miscellaneous chemicals.

Unusual equipment: Designed for experimental work on explosives, miscellaneous chemicals, leather cloth and lacquers.

32. Ault & Wiborg Company, The, Cincinnati, Ohio. Manufactures lithographic and printing inks, varnishes, litho stones, bronze powders, dry colors, acids, typewriter ribbons, carbon paper.

Research staff: A. B. Davis and 10 to 15 research chemists.

Research work: Full time of 11 to 16 on problems connected with dyestuffs and intermediates.

Unusual equipment: Especially for dyestuffs; technical laboratory for developing finished researches on a factory scale.

33. Babcock Testing Laboratory, 801 Ridge Road, Lackawanna, N. Y.

Research staff: Stephen C. Babcock, 2 chemists, 1 engineer and helpers.

Research work: Three-fourths time of 4 on milk pasteurization in original packages, sanitation, corrosion, destructive distillation of waste products to recover acetone, etc. Paint driers, varnish driers, glass, plastics.

Unusual equipment: Special apparatus for destructive distillation.

34. Babcock & Wilcox Co., The, Bayonne, N. J. Manufactures steam boilers.

Research staff: E. G. Bashore and 6 men.

Research work: Full time of 2 and part time of 4 on development of refractory materials, embrittlement of steel, aluminum coating on steel, betterment of boiler practice.

Unusual equipment: Special Bureau of Mines bomb cast from Illium metal. Spectroscopic apparatus; instruments for electrical measurements; viscosity and surface tension apparatus. Furnaces and apparatus for pyrometer and thermometer calibration. Two complete micrographic outfits. 150,000-pound Riehle testing machine, Upton-Lewis torsional and alternate bending machine, Brinell machine, scleroscope. Special equipment for refractories research. Special equipment for investigation of hydrogen embrittlement in steel.

35. Baker, J. T., Chemical Co., Phillipsburg, N. J.

Research staff: Wm. P. Fitzgerald and 3 assistants.

Research work: Full time of 1 on methods of testing reagents, methods of manufacture, etc.

36. Baldwin Locomotive Works, The, Philadelphia, Pa.

Research staff: H. V. Wille, 2 chemists and 7 assistants.

Research work: Small part time of 10 on problems connected with the plant.

Unusual equipment: 4 Olsen testing machines up to 600,000 pounds capacity; Brinell machines and scleroscope. Equipment necessary for determining elements in iron, steel, bearing metals and alloys.

37. Barrett Company, The, 17 Battery Place, New York, N. Y. Manufactures coal tar products. Research Laboratory Department at New York, Chemical Department at Frankford, Philadelphia, Pa. A works laboratory at each plant.

Research staff (*N. Y. laboratory*): C. R. Downs, 35 chemists and chemists' assistants; and 15 other men. Special Products Department, under direct control of Research Department, employs 60 mechanics and process men.

Research work: Full time of 50 on problems in connection with improvement of products or processes, and development of new uses for normal products. - General Manufacturing Department undertakes many experimental engineering problems, for which Research Department acts in consulting capacity.

Unusual equipment: Research laboratory occupies 4000 square feet; adjoining is a 40- x 50-foot building for experimental plant operations.

Research staff (*Frankford laboratory*): F. H. Rhodes and 15 chemists.

Research work: Full time of 16 on problems related to processes for new products; improvement of efficiency of present processes, and development of by-products; entirely in connection with own plant.

Unusual equipment: A few pieces of semi-works scale apparatus, such as agitators, vacuum driers, presses.

38. Bausch & Lomb Optical Co., Rochester, N. Y.

Research staff: Hermann Kellner, physical laboratory and optical glass plant, with 8 senior members, 4 junior members, 4 laboratory assistants and 3 technical assistants; Frank P. Kolb, chemical laboratory, 3 chemists and 2 assistants.

Research work: One-half time of 28 on optics and glass making, emery and rouge washing and grading, grinding and polishing experiments, cements, fillers, glass washing, glass silvering, metal plating.

39. Beaver Company, The, Buffalo, N. Y. Manufactures Beaver Board and other wallboards for buildings.

Research staff: B. W. Sidwell and 6 assistants.

Research work: Full time of 7 on pulp and paper problems, especially manufacturing and technical difficulties of wallboard production. **Beaver Valley Glass Company.** See H. C. Fry Glass Company.

40. Beckman and Linden Engineering Corporation, Balboa Building, San Francisco, Cal.

Research staff: J. W. Beckman, H. E. Linden, and a varying number of chemists, physicists and assistants.

Research work: Full time of staff on chemical, electrochemical and organic problems; salts occurring in natural brines; chemistry of barium and strontium salts; electrolytic manufacture of metallic magnesium directly from its oxides; cracking of oils by high-tension discharges.

Unusual equipment: Large motor-generator set for direct-current electrolysis and transformers for high-tension work.

41. Belden Manufacturing Company, 23rd St. & Western Ave., Chicago, Ill. Manufactures rubber insulated wires and cables, coil-winding machines, electromagnets and similar products.

Research staff: J. V. Van Buskirk.

Research work: Problems relating to own industry.

42. Bennetts' Chemical Laboratory, 1142 Market St., Tacoma, Wash. Analytical and consulting chemists, assayers and metallurgists.

Research staff: B. H. Bennetts, 4 chemists and 1 metallurgist.

Research work: Part time of 6 on concentration of manganese ores of Pacific Coast. Atomizing of copper, zinc and aluminum. Agricultural chemistry.

Unusual equipment: Metal atomizing plant for copper, zinc and aluminum.

Benzol Products Co. See National Aniline & Chemical Company.

43. Berry Bros., Inc., Detroit, Mich.

Research staff: Chas. T. Ellis and 3 chemists.

Research work: One-third time of 4 on paint vehicles, varnishes and shellacs.

44. Bethlehem Shipbuilding Corporation, Ltd., Union Plant, San Francisco, Cal.

Research staff: Bryant S. Drake and 4 assistant chemists.

Research work: Small part time of 5 on corrosion of boiler tubes in marine engineering; improvement of strength and homogeneity of non-ferrous alloys.

Unusual equipment: Electric furnace, gas calorimeter, low voltage generator, Olsen automatic and autographic universal testing machine of 200,000 pounds capacity; Shore scleroscope, Brinell hardness apparatus.

45. Bloede, Victor G., Co., Station D, Baltimore, Md. Manufacturing chemists; specialties, dyes, colors, gums.

Research staff: Victor G. Bloede, 1 chemist and 1 assistant chemist.

Research work: Full time of 1 and part time of 2 on starch modification, dextrinization and hydrolization.

Unusual equipment: Dextrinizers, mixing and bolting machines.

46. Boonton Rubber Manufacturing Company, Boonton, N. J. Makes electrical insulation and molded products.

Research staff: Geo. K. Scribner, 1 chemist, 1 electrical engineer and 1 mechanical engineer.

Research work: One-third time of 4 on such problems as non-carbonizing molded insulation for high-tension automobile ignition apparatus; synthetic resins.

Unusual equipment: 100,000-volt testing transformer; special apparatus for coating paper and fabric with resins in solution.

47. Boston Bio-Chemical Laboratory, (Inc.), The, 585 Boylston St., Boston, Mass.

Research staff: S. C. Prescott, 7 chemists, 1 bacteriologist and assistants.

Research work: Part time of 9 on agricultural problems, especially milk and food.

Unusual equipment: Van Slyke machine for amino nitrogen determination; immersion refractometer.

48. Brach, E. J., and Sons, 208 East Illinois St., Chicago, Ill. Manufactures candies. Has a small laboratory for control and research and a manufacturing laboratory.

Research staff: C. O. Dicken and 3 chemists.

Research work: One-third time of 4 on improvement of analytical methods and problems in manufacture of candy.

49. Bridgeport Brass Company, Bridgeport, Conn.

Research staff: Charles Ferry, 4 chemists, 1 mechanical engineer, 3 metallographists and 8 assistants.

Research work: One-third time of 17 on general problems incidental to manufacture and fabrication of a large variety of alloys.

Unusual equipment: Facilities for testing non-ferrous alloys, both chemically and physically. Metallographical laboratory for research.

50. Brown Company (formerly Berlin Mills Company), Berlin, N. H. Manufactures paper, sulphite, fiber and lumber.

Research staff: Hugh K. Moore and 21 chemical engineers; 17 works chemists in laboratories connected with the mills.

Research work: Full time of 22 on determination of chemical and physical factors which affect hydrogenation of oils; methods of manufacturing carbon tetrachloride, and determination of optimum conditions for method chosen; hydrolysis of wood-waste and fermentation of resulting liquors; uses for 'sulphite-pitch,' especially as a briquette-binder; machine for testing all classes of lubricating oils under any desired condition; conditions for commercial production of acetic anhydride; conditions for production of oxalic acid from wood-waste; structure and methods of impregnation of fiber tubes; commercial development of process for manufacturing carbon bisulphide and sulphur chloride; process for improving cooking acid for sulphite-fiber mill; methods of preparing acetylene tetrachloride; certain procedures in oil-analysis; improved method of preparing bleach powder; reduction of sizing-process in paper mill to an exact procedure; process for preparing monochlorbenzol.

Unusual equipment: New research laboratories nearing completion consist of four floors, having an area of over 11,000 sq. ft. and providing for bureau of tests, physical and chemical laboratories, large scale work, development section, microscopic work and general industrial photography. Laboratories equipped with jacketed kettles, tubular condensers, vacuum pumps, lummus continuous fractionating still, Bristol pyrometer, Sharples laboratory super-centrifuge, Andiffren-Singrun refrigerating machine, quartz mercury-vapor lamp, Sperry laboratory filter press, Schaum and Uhlinger centrifugal-machine. Lovibond tintometer, Greiner colorimeter, spectroscope, pressure-stabilizer, Stormer viscosimeter. In storehouse a large electric-furnace transformer and switchboard, lubricating-oil tester, high-pressure gas compressor, various pieces of quartz apparatus.

51. Brown & Sharpe Mfg. Co., Providence, R. I. Manufactures machinery and tools.

Research work: On gray iron.

52. Brunswick-Balke-Collender Co., The, Muskegon, Mich.

Research staff: A. Brill and 3 men.

Research work: One-fourth time of 4 on rubber, glue and wood-working.

53. Buckeye Clay Pot Co., Bassett and Ontario Sts., Toledo, Ohio. Manufactures fire-clay products.

Research staff: Arthur F. Gorton.

Research work: Two-thirds time of 1 on tests of clay including determinations of dry transverse strength, water of plasticity, linear drying shrinkage, screen analysis for fineness, etc., also melting point, ability to withstand load at high temperatures, porosity, linear burning shrinkages, burned strength, and other properties of burned clay.

Unusual equipment: For making both routine and special tests of clays.

54. Buffalo Foundry and Machine Co., 1543 Fillmore Ave., Buffalo, N. Y. Makes vacuum dryers, evaporators and industrial chemical apparatus.

Research staff: Willard Rother, Metallurgical and Physical Testing Department; D. J. Van Marle, Organic Chemical Department;

Charles Lavett, Vacuum Laboratory and Testing Departments; 2 assistant chemists and 5 assistant engineers and operators.

Research work: Small part time of 10 on practical experiments on materials furnished by customers to determine in advance what can be done by means of certain apparatus.

Unusual equipment: Completely equipped metallurgical, chemical and testing laboratories.

55. Burdett Manufacturing Company, St. Johns Court at Fulton Street, Chicago, Ill. Makes oxygen and hydrogen gas generating apparatus.

Research staff: E. G. Luening, 1 chemist and 1 assistant chemist.

Research work: Full time of 1, part time of 2 on rates of diffusion of gases, explosive limits of gases, effect of electrolytic action incident to decomposition of water on various materials used in construction (steel, rubber and asbestos) development of special compounds for permanent resistance to such action and to action of comparatively strong alkaline solutions.

Unusual equipment: Equipment for analysis of gases is complete.

Burke Tannery. See Kistler, Lesh & Company.

56. Butterworth-Judson Corporation, Newark, N. J. Successor to American Synthetic Dyes, Inc.

Research staff: N. F. Borg, 7 chemists, 2 assistant chemists and 1 helper.

Research work: Full time of 11 on problems relating to dye manufacture.

Unusual equipment: Equipment particularly adapted for work on intermediates, dyes, acids and heavy chemicals, including semi-commercial scale apparatus.

57. Byers, A. M., Company, Pittsburgh, Pa. Manufactures wrought iron pipe, oil well tubing and casing.

Research staff: James Aston, several metallurgists and chemists, and assistants.

Research work: One-half time of staff on corrosion and protective coatings of iron; development of wrought iron.

Unusual equipment: For chemical analyses and microscopic examinations of iron and steel; apparatus for corrosion tests and for determining physical characteristics.

By-Products Coke Corporation, See Semet-Solvay Company.

58. Cabot, Samuel, Inc., 141 Milk St., Boston, Mass.

Research staff: Samuel Cabot and 1 assistant.

Research work: One-third time of 2 on coal tar distillates, disinfectants, paints, stains, varnishes.

59. Carborundum Company, The, Niagara Falls, N. Y. Manufactures abrasive materials.

Research staff: O. Hutchins, 1 ceramist, 1 organic chemist (glue, rubber, shellac), 15 chemical engineers, 7 assistants with technical experience and 4 non-technical helpers.

Research work: Full time of 29 on ceramic and general technical problems, particularly those of purely scientific nature. Development of new products and improvement on present electric furnace processes. In furnace laboratory are undertaken problems of semi-commercial nature on fairly large scale; investigations on refractories, study of

electric furnace operation and manufacture of some electric furnace products.

Unusual equipment: Microscopic and photo-micrographic outfits. A number of small electric furnaces, an Arsem vacuum furnace, an arc and resistance furnace, several small gas furnaces. Three laboratories and much experimental work in plant.

60. Carnegie Steel Company, 1054 Frick Annex Building, Pittsburgh, Pa. Central Research Bureau for United States Steel Corporation.

Research staff: J. S. Unger; chemists, physicists, engineers and assistants selected from works staffs as needed.

Research work: At steel plants, covering problems of steel manufacture, properties of refractories and other materials used in steel manufacture, by-products and the testing of finished products, particularly service tests.

61. Carus Chemical Company, La Salle, Ill. Manufactures permanganate of potash, recovered manganese, saccharine.

Research staff: Leslie G. Graper and 5 men.

Research work: Three-fourths time of 6 on development of process for producing calcium and zinc permanganates, chlorosulphonic acid, methyl and ethyl sulphate, saccharine; work on guaiacol.

62. Case Research Laboratory, Auburn, N. Y.

Research staff: Theodore W. Case, 3 technical men and several assistants.

Research work: Full time of at least 4 on problems in light and photoelectricity.

Unusual equipment: Apparatus for photo-electric work.

63. Central Scientific Company, 460 East Ohio St., Chicago, Ill. Manufactures physical, chemical, agricultural and biological apparatus.

Research staff: Capt. de Khotinsky and 1 assistant.

Research work: Large part time of 2 on development and improvement of apparatus manufactured.

Unusual equipment: For electrical testing.

64. Champion Ignition Co., Flint, Mich.

Research staff: T. G. McDougal and 2 ceramic engineers.

Research work: Three-fourths time of 3 on perfection of high temperature insulation (electrical); super-refractory furnace linings for own use; continuous high temperature factory processes.

Unusual equipment: Laboratory and factory facilities for operations up to 1800 degrees C. Equipment for measuring electrical leakage up to 900 degrees C.

65. Chandler Engineering Corporation, 74 Ashland Place, Brooklyn, N. Y. Designs and builds special machinery.

Research staff: Edw. F. Chandler and a number of experts.

Research work: Engineering in connection with special machinery, mechanical, electrical, chemical, aeronautical, marine and ordnance.

Unusual equipment: Chemical and physical laboratories and experimental machine shops, well equipped for scientific investigation.

66. Charlotte Chemical Laboratories, Inc., 606 Trust Building, Charlotte, N. C.

Research staff: F. J. Bartholomew, 2 chemists, 3 chemical engineers, 1 mechanic and 1 laborer.

Research work: Two-thirds time of 8 on development of plant processes; electro-metallurgy of rare elements.

Unusual equipment: Electric vacuum furnaces. Large capacity grinding units.

67. Chase Metal Works, Waterbury, Conn. Manufactures copper, brass and other non-ferrous metals.

Research staff: C. H. Stokesbury, 5 chemists, 4 engineers and about 35 assistants.

Research work: Full time of 2 on investigations of properties of brass and copper.

Unusual equipment: Complete chemical equipment for brass mill laboratory; physical laboratory equipment, 100,000-pound Olsen testing machine, 50,000-pound Riehle testing machine, 10,000—1,000-pound Olsen wire testing machine, Brinell machine, Spring tester, scleroscopes; metallographic equipment, electric annealing muffles with electrically controlled thermostats.

68. Cleveland Testing Laboratory Co., The, 511 Superior Building, Cleveland, Ohio.

Research staff: C. A. Black, 2 chemists and assistants as required.

Research work: One-third time of 3 on problems in connection with industrial plants.

Unusual equipment: Apparatus for steel metallurgical work and for food work.

69. Columbia Graphophone Manufacturing Company, Bridgeport, Conn. A laboratory also in New York.

Research staff: Dr. de Stubner.

Research work: Part time of 1 on semi-plastics in connection with record manufacture.

70. Commonwealth Edison Company, 120 West Adams St., Chicago, Ill. Operator of large electric light and power generating and distributing systems.

Research staff: Louis A. Ferguson and 6 trained men.

Research work: Part time of 7 on insulation deterioration, potential rises due to switching operations, heat dissipation, electric furnace investigations and storage battery problems.

Unusual equipment: Primary and secondary standardizing instruments, especially for heavy currents; oscillograph and high potential instruments; special generators and transformers; extensive photometric equipment; apparatus for dielectric and insulation tests.

71. Condensite Company of America, Bloomfield, N. J. Manufactures synthetic gums, plastic molding preparations and hydrochloric acid.

Research staff: D. S. Kendall and 2 assistants.

Research work: Over one-half time of 3 on improvement and development of phenolic condensation products for industrial uses; development of a protective coating for aeroplane wings; molding compounds for fountain pens.

Unusual equipment: Hydraulic pump and press; vacuum still and vacuum drying oven; mixers, ball mills, impregnating apparatus equipped with vacuum and pressure.

72. Corn Products Refining Company, Edgewater, N. J.

Research staff: Christian E. G. Porst, 3 chemical engineers, 4 chemists and 13 helpers and laborers.

Research work: Full time of 21 on problems confined to the industry.

73. Corning Glass Works, Corning, N. Y. Makers of technical glass.

Research staff: E. C. Sullivan, 4 chemists, 7 physicists and 4 engineers.

Research work: One-third time of 16 on physical properties of glass as related to chemical composition; lens design; furnace design, refractories; manufacturing problems; and new uses for glass.

Unusual equipment: Facilities for high temperature work.

Corona Chemical Company. See Patton Paint Company.

74. Cosden & Company, Tulsa, Okla. Producers and refiners of petroleum.

Research staff: Charles K. Francis and about 50 chemists, physicists, engineers and assistants.

Research work: One-third time of about 50 on petroleum and petroleum products, including gas.

Unusual equipment: General chemical and physical equipment for petroleum work; experimental crude, pressure and steam stills, agitators, tanks, filters, wax presses, sufficient for complete investigation of any crude or semi-refined oil.

75. Cramp, William, & Sons Ship & Engine Building Co., The, Philadelphia, Pa. I. P. Morris Hydraulic Laboratory.

Research staff: Frank H. Rogers, 1 machinist, 2 engineers and 2 observers.

Research work: Three-fourths time of 6 in the field of hydraulics and hydrodynamics.

Unusual equipment: Chemical and physical laboratory equipped for work on brasses, bronzes and material testing; under construction a hydraulic testing laboratory, designed especially for hydraulic turbines, centrifugal pumps, etc.; will contain testing flume, tank for rating current meters and similar work, weirs and necessary instruments.

76. Crane Co. (Metallurgical Department), 510 Main St., Bridgeport, Conn. and 836 South Michigan Ave., Chicago, Ill. Manufactures valves, pipes, fittings and other supplies for water, gas and steam work.

Research staff (*Bridgeport laboratory*): Allen P. Ford, 2 metallurgists, 1 chemist, 3 assistant chemists and 2 helpers.

Research work: Small part time of 9 on problems connected with the industry.

Unusual equipment: Entirely equipped for routine metallurgical work. 100,000-pound tensile testing machine; transverse, torsion and hardness testing machines.

Research staff (*Chicago laboratory*): L. W. Spring, 1 assistant and 12 men, 2 of whom are doing physical and metallographic testing.

Research work: One-tenth time of 14 on problems connected with the industry.

77. Crane & Co., Dalton, Mass. Paper makers.

Research staff: C. Frank Sammett and 1 chemist.

Research work: Small part time of 2 on improving methods and conditions of manufacture.

Unusual equipment: Well equipped for research and control work pertaining to paper manufacture.

78. Cudahy Packing Company, The, South Side, Omaha, Nebr.

Research staff: Wilson H. Low, 10 chemists and 4 workers.

Research work: Part time of 15 on pepsin, pancreatin, glues, curing meats, solutions, and bacterial problems.

79. Cumberland Mills, Cumberland Mills, Me. S. D. Warren & Co., Boston, Mass., proprietors. Manufactures pulp and paper.

Research staff: E. Sutermeister, 2 to 4 chemists and 2 or 3 assistants.

Research work: One-third time of 6 on problems relating to pulp and paper industry. Tests of various woods and fibrous materials; studies on soda pulp process and on solubility, adhesive strength and viscosities of caseins and their solutions and coating mixtures; destructive distillation of black liquor and identification of products obtained; studies of expansion of papers with increasing humidity; bleaching studies on sulphite and soda fiber to show effects of variable factors; development of a beating test to show relative strength of fibers; investigations relating to manufacture of satin white; studies of defects in papers and of means to overcome them; tests on factors influencing rosin-sizing of paper; development of a test for sulphur in paper.

Unusual equipment: Small beater; kneader; bleaching equipment; hand moulds; small rotary soda digester; small stationary sulphite digester; pebble mills; Schopper tensile strength tester; Schopper folding tester; Ashcroft testers; Ingersoll glarimeter; Emerson calorimeter; chemical apparatus necessary for inorganic and organic testing analysis and research. Available in mill; 400-pound vertical soda digester; 350-pound beater, and small Fourdrinier paper machine. Apparatus to study foaming of coating mixtures, apparatus to study abrasive qualities of clays and fillers (in process of development).

80. Curtiss Engineering Corporation, The, Garden City, N. Y. Curtiss Aerodynamic Research Laboratories. Plant is primarily an experimental plant, devoted to aeronautical research in all forms. Curtiss Aeronautical Library is a very complete collection of aeronautic literature in all languages.

Research staff: J. G. Coffin, 2 wind tunnel operators, 1 aeronautic engineer, 1 model maker and mechanic and 1 motor man.

Research work: Full time of 6 on any special investigation of a theoretical nature; wind tunnel tests of all kinds; tests on new wing sections at various speeds; tests on new models, giving stability and performance before full-size machine is built or flown; tests on streamline forms, such as fuselages, dirigible shapes, flags, propellers, gasoline pumps and generator turbines.

Unusual equipment: Three wind tunnels in operation. (a) One large Eiffel type wind tunnel run by a 400-H. P. gasoline motor, electrically controlled; speeds up to 100 miles per hour; balance is specially designed of uni-pivot type, sensitive to less than $1/10,000$ pound of wind force. (b) One 4-ft. wind tunnel of improved type, actuated by a Curtiss OX Motor; specially designed air turbine propeller; special Curtiss type wind tunnel balance; air speeds up to about 80 miles per hour. (c) One 2-ft. wind tunnel for qualitative work, run by an electric motor giving wind speeds approximately 30 miles per hour. A completely equipped model-making and instrument-making shop.

81. Cutler-Hammer Mfg. Co., The, Milwaukee, Wis. Manufactures electric controlling devices.

Research staff: Arthur Simon, 1 physicist, 2 assistant engineers, 1 assistant physicist, 1 glassblower and mechanical helpers as needed. Has help of Experimental Department with its staff of developing engineers and mechanics.

Research work: Full time of 6 in connection with electrical discharge in gas, particularly evacuated tubes and bearing on control of electric currents.

Unusual equipment: Good equipment of vacuum pumps; glass-blowing shop; testing equipment of electrical nature.

82. Davis-Bournonville Company, Jersey City, N. J. Manufactures oxy-acetylene welding and cutting apparatus.

Research staff: Stuart Plumley and 1 chemist.

Research work: Large part time of 2 on oxy-acetylene process and special instruction in apparatus and use of process.

Unusual equipment: A small gas laboratory for acetylene applied to welding and cutting apparatus.

83. Davison Chemical Company, Baltimore, Md. Manufactures sulphuric acid.

Research staff: A. E. Marshall and trained research men as required.

Research work: Full time of staff on improvement of manufacturing processes for sulphuric acid and utilization of waste materials.

Unusual equipment: Semi-commercial equipment for development of processes evolved in laboratory.

84. Dayton Engineering Laboratories Co., Dayton, Ohio.

Research staff: J. H. Hunt, 1 research engineer, 4 experimental engineers, 1 chief chemist, 2 chemists and 21 additional members of the staff.

Research work: One-half time of 30 on development of ignition and special electrical equipment for automotive apparatus.

Unusual equipment: Refrigeration plant providing cold-room for starting tests and equipment for delivering 400 cubic feet of air per minute at 0 degrees F. with incoming air 90 degrees F., 70% saturation, used for cold running tests. Dynamometers for engine tests with usual fittings. Oscillograph adapted to use on tests of ignition apparatus.

85. Dearborn Chemical Company, McCormick Building, Chicago, Ill. Specialty, scientific boiler feed water treatment.

Research staff: D. K. French and 1 or more chemists and assistants.

Research work: Small part time of 2 on scientific boiler feed water treatment.

Unusual equipment: Mahler Atwater bomb calorimeter, apparatus for mineral, sanitary and bacteriological analyses of water, and for physical and chemical testing of oils.

86. Dehls & Stein, Inc., 237 South St., Newark, N. J. Manufacturing chemists.

Research staff: Dr. L. Stein and 2 chemists.

Research work: One-half time of 3 along lines of fermentology; also production of intermediates for dye-stuff industry.

87. DeLaval Separator Co., The, 165 Broadway, New York, N. Y.
Makers of centrifugal machinery.

Research staff: Wallace Alexander and 2 assistants.

Research work: Full time of 3 on purifying used oils, clarification and separation of commercial products, making of emulsions, clarification of extracts, purifying of crude and fuel oils, etc.

Unusual equipment: Centrifugal apparatus of all classes.

88. Detroit Edison Company, The, Detroit, Michigan. Operating large electric light and power generating and distributing systems.

Research staff: C. F. Hirshfeld, 1 engineer, 2 to 8 trained men, and 4 or more assistants.

Research work: Three-fourths time of about 12 on studies of boiler efficiency and life; condenser and lubrication problems; and furnace design and heat loss investigations.

Unusual equipment: Optical and platinum resistance pyrometers; precision electrical measuring instruments; instruments for furnace and flue tests.

89. Detroit Testing Laboratory, The, 674 Woodward Avenue, Detroit, Mich.

Research staff: F. W. Robison and about 20 chemists.

Research work: Major portion of time of 2 or 3 members of staff along manufacturing chemical lines, food problems, possibilities of shale, agricultural problems.

90. Diamond Match Co., The, Oswego, N. Y.

Research staff: Frederick Van Dyke Crusier, 7 chemists and chemical engineers, 2 mechanical engineers and 5 assistants.

Research work: One-half time of 15 on problems connected with match manufacture and its allied branches.

91. Digestive Ferments Company, Detroit, Mich.

Research staff: Dr. Carl S. Oakman, 6 chemists and 5 bacteriologists.

Research work: Two-thirds time of 12 on physiological and proteid chemistry and commercial classifications of bacteriology.

Unusual equipment: Highly perfected apparatus for the estimation of hydrogen ion concentration.

92. Dill & Collins Co., Richmond and Tioga Sts., Philadelphia, Pa.
Paper makers.

Research staff: Frank H. Mitchell, 2 chemists, 2 chemical engineers and 3 assistants.

Research work: One-half time of 1 chemist to full time of 2 chemists on problems of the paper industry.

93. Doehler Die-Casting Co., Court, Ninth and Huntington Sts., Brooklyn, N. Y. Laboratory also at Smead and Prospect Aves., Toledo, Ohio.

Research staff (*Brooklyn laboratory*): Charles Pact, 5 chemists, 6 junior chemists, 1 fuel engineer, 1 steel metallurgist.

Research work: One-fifth time of 14 on problems pertaining directly or indirectly to casting of metals, particularly non-ferrous metals.

Research staff (*Toledo laboratory*): Charles Pact, 1 metallurgist, 1 chemist and 5 junior chemists.

Research work: One-fifth time of 8 on problems pertaining to casting of metals.

Dominion Natural Gas Co., Ltd. See Medina Gas & Fuel Co.

94. Dorr Company, The, 101 Park Ave., New York, N. Y. Engineers. Testing plant and laboratory at Westport Mill, Westport, N. Y.

Research staff: John A. Baker, 1 analytical chemist, 1 chemical engineer, 1 mechanical engineer and 4 assistants. In New York office 6 engineers available for advice and work at Westport at intervals.

Research work: Three-fourths time of 8 on extraction of nitrate from caliche, recovering fertilizer from tannery sewage, leaching copper ores, treatment of tin concentrates, investigating a flotation process, and paint grinding.

Unusual equipment: Testing plant and laboratory occupy 2½-story building 40 x 80 feet, equipped with bins, small crusher, ball mill and classifier in closed circuit for fine grinding, tanks for agitating, thickeners for decantation, an Oliver filter, a small Wilfley table, flotation machines, and an electric roasting furnace; designed to work out hydrometallurgical problems, and to do work in connection with flotation, leaching, classification, counter-current washing, and trade wastes treatment; equipped to make settling tests to determine size of thickeners needed in sedimentation problems.

95. Drackett, P. W., & Sons Co., The, Cincinnati, Ohio. Manufactures acids, alkalis and other heavy chemicals.

Research staff: B. S. Hull, 1 chemist and 1 assistant.

Research work: Development of products and their uses.

96. Duesenberg Motors Corporation, Elizabeth, N. J.

Research staff: F. S. Duesenberg and 1 engineer.

Research work: Part time of two on development of internal-combustion motors.

Unusual equipment: Particularly well equipped for testing high-powered engines, and small high speed motors.

97. du Pont, E. I., de Nemours & Company, Wilmington, Del. Chemical Department operates four research laboratories in addition to organization at its main office. (Information concerning the entire department is followed by separate accounts of the four laboratories.)

Research staff: Charles L. Reese, 400 graduate chemists and engineers, 221 other salaried employees and 567 payroll employees.

Research work: Practically full time of 1189 on manufacturing operations of the duPont Company, including miscellaneous chemicals, dyes and intermediates, explosives, coated fabrics, plastics, pyroxylin solutions, lacquers, paint and varnish including the production of miscellaneous raw materials as mineral acids and nitrates of soda.

Delta Laboratory, Arlington, N. J.

Research staff: R. P. Calvert, 24 graduate chemists and engineers, 9 other salaried employees and 24 payroll employees.

Research work: Practically full time of 58 on pyralin, pyroxylin solutions, and raw materials therefor.

Unusual equipment: Fairly complete line of semi-manufacturing scale equipment for the experimental manufacture of paper, nitro-cellulose and pyralin.

Eastern Laboratory, Box 424, Chester, Pa.

Research staff: A. M. Comey, 39 graduate chemists and engineers, 24 other salaried employees and 135 payroll employees.

Research work: Practically full time of 199 on high explosives and raw materials therefor, processes of manufacture, and methods of testing.

Unusual equipment: Very complete facilities for testing properties of explosives.

Experimental Station, Henry Clay, Del.

Research staff: Hamilton Bradshaw, 84 graduate chemists and engineers, 59 other salaried employees and 193 payroll employees.

Research work: Practically full time of 337 on smokeless powder, black powder, coated fabrics, nitrocellulose, heavy chemicals, paint and varnish—also, miscellaneous, organic and inorganic chemicals and raw materials therefor and manufacturing process and methods of testing.

Unusual equipment: Equipment for experimental manufacture of propellant powders, constant temperature magazines for stability tests and storage of smokeless powder, experimental equipment for the manufacture of coated fabrics, ranges for testing small arms powders for velocity, pressure and accuracy.

Jackson Laboratory, Box 525, Wilmington, Del.

Research staff: Fletcher B. Holmes, 173 graduate chemists and engineers, 53 other salaried employees and 215 payroll employees.

Research work: Practically full time of 442 on dyes and intermediates.

Unusual equipment: Extensive equipment for semi-works operation and investigation of a variety of chemical processes.

98. Eagle Printing Ink Co., The, 265 Gates Ave., Jersey City, N. J. Manufactures printing and lithographic inks and dry colors.

Research work: Confined to examination and development of aniline dyes and testing of raw materials.

99. Eastern Manufacturing Company, Bangor, Me. Manufactures papers.

Research staff: R. S. Rao, 3 chemists and several assistants.

Research work: Part time of staff on problems connected with paper-making; moisture in loft dried papers before and after calendering.

Unusual equipment: For complete analysis of coal, sulphur, lime caustic, clays, paper, fillers of all descriptions, pigments, dyes. All modern apparatus for coal analysis, small paper beater, apparatus for determining slowness of beater stock, strength of stock in beaters and on finished-paper.

100. Eastman Kodak Company, Rochester, N. Y. Manufactures cameras, plates, films and other photographic supplies.

Research staff: C. E. K. Mees, 40 trained men (chemists, physicists, photographic experts); 30 assistants.

Research work: Full time of 71 on theory of photography, development of new photographic materials and methods and study of theory of manufacturing processes. Does not carry on routine testing nor deal with manufacturing problems in general. Since 1913 has published

more than seventy-five scientific communications, dealing chiefly with theory of photography and with applied optics.

Unusual equipment: Full equipment of chemical and physical instruments and a number of special instruments required for photographic sensitometry and manufacture; a complete experimental plant for manufacturing photographic films, plates, papers and emulsions.

101. Edison, Thomas A., Laboratory, Orange, N. J.

Research staff: Wm. H. Meadowcroft and a number of helpers.

Research work: Full time of staff on industrial researches confined to problems arising in connection with the company's enterprises. These include manufacture of electrical equipment, storage batteries, sound-recording-and-reproducing devices and Portland cement. Not a research laboratory, as the term is generally understood among engineers and physicists, nor a laboratory for promoting industrial research generally speaking, although engaged in industrial research.

102. Eimer & Amend, Third Ave., 18th to 19th Sts., New York, N. Y. Manufacture industrial and educational laboratory apparatus, assayers' materials, chemicals and drugs.

Research staff: C. G. Amend and 3 chemists.

Research work: Large part time of 2 on organic chemicals; special glass apparatus for scientific investigations.

103. Electrical Testing Laboratories, 80th St. and East End Ave., New York, N. Y. Operates on a commercial basis and undertakes work for any responsible person or institution.

Research staff: Clayton H. Sharp, 1 chief engineer and 7 research men.

Research work: One-tenth time of 9 on dielectric losses; thermal conductivity of heat insulators at high and low temperatures; radiation efficiency of gas heaters; special cases of electrolysis by stray currents; breakdown voltage of sheet insulation.

Unusual equipment: Very complete for electrical standardizing and research, photometry, mechanical measurements, fuel testing, paper and textile testing, thermometer and pyrometer standardization.

104. Electro Chemical Company, The, Dayton, Ohio. Manufactures electrolytic cells for producing sodium hypochlorite.

Research staff: John Gerstle and 1 chemical engineer.

Research work: Two-thirds time of 2 in connection with producing sodium hypochlorite from a sodium chloride solution, principally increasing efficiency of electrolytic cells.

105. Electro-Metallurgical Company, Niagara Falls, N. Y.

Research staff: F. M. Becket and 20 men.

Research work: Full time of 21 on metallurgical products, chiefly ferro alloys. Refractories. Problems pertaining to manufacture and use of calcium carbide, ferro alloys and other electric furnace products.

Unusual equipment: Electric furnaces of various types and widely different capacities. Alloy testing and pyrometric equipment. Excellent analytical laboratory facilities.

106. Ellis, Carleton, Laboratories, 92 Greenwood Ave., Montclair, N. J.

Research staff: Carleton Ellis and 6 to 12 chemists and engineers.

Research work: Full time of staff on petroleum and vegetable oils,

hydrogenation of oils, organic solvents, gasoline, and a large number of catalytic processes, etc.

Unusual equipment: Mechanical equipment such as mixers, autoclaves, steam-jacketed kettles, filter presses, grinding and crushing machinery, furnaces, etc.

107. Emerson Laboratory, 145 Chestnut St., Springfield, Mass.

Research staff: H. C. Emerson and 5 chemists.

Research work: One-fourth time of 6 on paper and textile problems.

108. Empire Companies, The, including Empire Gas & Fuel Company, Empire Refineries, Incorporated, Empire Gasoline Company, Empire Pipeline Company, Wichita Natural Gas Company, Producers Refining Company, Standard Asphalt & Refining Company, and various other companies, all subsidiaries of the Cities Service Company, maintain a central chemical organization in charge of general chemical work at the various plants of these companies, and also maintain two general laboratories devoted to chemical research, at Bartlesville and Okmulgee, Okla.

Empire Gas & Fuel Company, Bartlesville, Okla. Also laboratory at Okmulgee.

Research staff: R. M. Isham (Okmulgee laboratory), L. E. Jackson (Bartlesville laboratory) 7 research chemists, and a number of routine chemists and assistants who devote most of their time to plant control work.

Research work: Full time of 9 on problems connected with oil refining, cracking of oils, synthesis of organic compounds, crude petroleum and natural gas. Following laboratory work, semi-commercial apparatus or plant is often built before a large unit or plant is installed.

Empire Gasoline Company, 1st and Wyandotte Aves., Bartlesville, Okla.

Research staff: N. M. Hutchinson, 1 chief technologist, 8 engineers and 33 skilled and unskilled assistants.

Research work: Small part time of 43 on problems arising in oil and gas business, development of new processes and new machines.

109. Falls Rubber Company, The, Cuyahoga Falls, Ohio.

Research staff: G. D. Kratz, 4 chemists and 2 engineers.

Research work: One-half time of 5 and one-fourth time of 2 on the investigation of raw rubbers and the process of vulcanization; new machines and mechanical methods.

Unusual equipment: For the study of problems in the vulcanization of rubber.

110. Firestone Tire & Rubber Company, Akron, Ohio.

Research staff: John Young, 7 chemists, 6 chemical engineers and 6 mechanical engineers.

Research work: Full time of 20 on development of automobile tires, tubes and rims, and studies of processes and raw materials involved.

111. Fisk Rubber Company, The, Chicopee Falls, Mass. Manufactures tires and sundries.

Research staff: R. B. Naylor and 2 chemists.

Research work: Full time of 3, almost entirely organic chemistry.

112. FitzGerald Laboratories, Inc., The, Niagara Falls, N. Y.

Research staff: F. A. J. FitzGerald, 4 chemists and assistants.

Research work: One-half time of 5 on thermo-electrochemical problems mainly electric furnace work; studies of heat losses and efficiencies, of carbon and graphite electrode manufacture, of various refractories and methods of manufacturing same. Metallurgical problems involving use of electric furnace.

Unusual equipment: Thermo-electrochemical apparatus, suitable transformers, electric furnace supplies, pyrometers, electrical measuring instruments, etc.

113. Florida Wood Products Co., Jacksonville, Fla. Manufactures phosgene gas.

Research staff: E. B. Smith and 5 or 6 chemists.

Research work: Full time of 6 on development of products of phosgene gas; pharmaceuticals derived from wood products.

Unusual equipment: Special facilities for handling destructive distillation problems, being equipped with iron retorts capacity of 50 pounds to 1500 cubic feet.

114. Fry, H. C., Glass Company, and Beaver Valley Glass Co., Rochester, Pa.

Research staff: S. R. Scholes and 2 assistants.

Research work: More than one-half time of 3 on new varieties and compositions of glass. This work is carried out first in small crucible meltings and then in regular factory pots.

Unusual equipment: Large laboratory equipped with traveling crane, motors, air compressors, high-temperature gas-fired furnace of 100 cubic feet capacity.

115. Gallun, A. F., & Sons Co., Milwaukee, Wis. Proprietor, Empire Tannery.

Research staff: J. A. Wilson and 3 trained men.

Research work: Full time of 4 on producing leather more efficiently. Problems are so deeply involved as to include nearly every branch of pure chemistry, but deal especially with the molecular mechanism of the equilibria obtaining when colloid jellies are left in contact with sols and true solutions.

Unusual equipment (in use or planned): Laboratories for investigations involving analyses of leather and materials used in making leather, for electrometric research, dealing especially with measurements of ion concentrations, for work involving microscopy, ultramicroscopy, photomicrography and spectroscopy; fume chamber for practical work giving rise to obnoxious gases; experimental tannery.

116. General Bakelite Company, Perth Amboy, N. J. Supplementary laboratory in Yonkers, N. Y.

Research staff: L. H. Baekeland, 2 engineers and 5 chemists.

Research work: Full time of 8, confined almost exclusively to phenol-formaldehyde condensation products, both development and commercial applications.

Unusual equipment: In form of electric ovens, stills, vulcanizers, pebble mills and rubber machinery.

117. General Chemical Co., Research Dept., 25 Broad St., New York, N. Y.

Research staff: H. Wigglesworth and approximately 45 chemists.

Research work: Full time of 46 on improving existing processes of the company, and devising new processes.

Unusual equipment: New research and industrial laboratory just completed.

118. General Electric Company, Schenectady, N. Y. Laboratories also at Lynn and Pittsfield, Mass., Harrison, N. J. and Cleveland, Ohio.

Research staff: Willis R. Whitney, 2 assistant directors, 50 chemists, 12 physicists, 13 engineers, 50 research assistants, and machinists, glass-blowers, electricians and clerks.

Research work: Full time of 225 devising new forms of electric lights and improving existing forms. Development of Coolidge X-ray tube. Invention of new and development of existing forms of electric equipment and apparatus. Study of metals and alloys for electrical uses. Wireless transmission development. Study of insulation. Many fundamental physical and chemical scientific researches also are carried on.

Unusual equipment: A 7-story building of 66,500 sq. ft. floor space. Varied, extensive and complete equipment for all kinds of electrical and allied research.

119. General Motors Corporation, Detroit, Mich. Manufactures automobiles and accessories. Laboratory serves for inspection as well as development and research. There are four main departments, chemical, metallurgical, electrical and physical.

Research staff: J. M. Lea, 10 chemists, 4 metallurgists, 4 electrical experts and 4 physical testing experts.

Research work: One-fourth time of 23 on analyses of iron, steel and non-ferrous alloys, tests on distillation petroleum products, paints, varnishes, etc.; iron and steel as rolled into shapes, heat-treating and the development of new steels; pyrometers, automobile electrical equipment and storage batteries; engines and automobile accessories.

Unusual equipment: Complete set of physical testing machines and two dynamometers for engine testing and other tests on automobile assemblies. In addition to that of the laboratory, the equipment of constituent plants is available.

120. General Tire & Rubber Co., Akron, Ohio.

Research staff: H. B. Pushee and 4 men.

Research work: One-tenth time of 5 on development of better rubber compounds; rubber accelerators; coefficient of vulcanization.

121. Glidden Company, The, Cleveland, Ohio. Manufactures varnishes, enamels, paints, stains.

Research staff: W. M. Waldie, 9 chemists, 2 chemical engineers and a number of physicists. There is a research committee of 3 members, changed from time to time.

Research work: Full time of research committee of 3 on developing synthetic resin, synthetic turpentine, and insecticidal, fungicidal and germicidal products.

Unusual equipment: Fume and boiling stacks, electrical and gas ovens, retorts, disintegrators, spraying apparatus, digestors, and all kinds of apparatus necessary for research in connection with gums, oils and coal tar residues.

122. Globe Soap Co., St. Bernard, Ohio.

Research staff: C. P. Long, 4 chemists and 4 chemical engineers.

Research work: One-tenth time of 9 on problems of the industry.

123. Goodrich, B. F., Company, The, Akron, Ohio. Makes rubber goods of every description.

Research staff: George Oenslager, 1 physicist, 4 chemists and 3 assistants.

Research work: Full time of 9 on study of physical properties of rubber and all materials used directly or indirectly in the industry. Devulcanization of rubber, manufacturing synthetic rubber, accelerators for vulcanizing rubber, and study of great variety of minerals, oils, fats, resins, fabrics, etc., used in rubber goods.

Unusual equipment: Three laboratories. Physical, equipped with compounding mills, vulcanizing presses, vulcanizers, vacuum dryers, ball mills and machines for determining tensile strength and other physical properties of all the materials used; general chemical, and research chemical well equipped for study of problems and fundamental principles in manufacture of rubber goods.

124. Goodyear Tire & Rubber Company, The, Akron, Ohio:

Research staff: C. R. Johnson development manager, J. E. Hale, chief tire designer, in charge of Tire Design Division, K. B. Kilborn, chief experimental engineer, in charge of Machine Design, Mechanical Goods Design and Standards Divisions, R. C. Hartong, chief chemist, in charge of Technical Service and Chemical Divisions, 6 research chemists, 3 research physical chemists and physicists, 7 chemical engineers, 8 assistant engineers, 8 compound development chemists, 24 technical service chemical and mechanical engineers, 24 chemical laboratory chemists and assistant chemists, 24 physical laboratory assistants, 10 machine design engineers, 22 machine designers, 24 machine design detailers and tracers, 49 machine design workshop machinists, 8 foremen and experimental tryout men, 8 mechanical goods design engineers, 10 tire design engineers, 8 tire design assistants. Total employees of department approximately 525.

Research work: Full time of research and development men on mechanism of vulcanization, compounds which affect the rate of vulcanization, development of organic compounds especially adapted to rubber work; application of physical chemistry to study of rubber and compounding materials; physical properties of rubber, and methods of testing and studying them; chemistry of fibrous materials, particularly cotton, and properties of materials used as films or protective agents; industrial processes, such as reclaiming and coagulation of rubber.

Unusual equipment: Chemical equipment includes micrographic and ultra-violet-light apparatus. For chemical engineering there is an industrial laboratory, well equipped with semi-production grinding, sifting and washing apparatus, mixing kettles, autoclaves, condensers, filter presses and other apparatus. Standards division is very completely equipped with apparatus for chemical and physical testing.

125. Gray Industrial Laboratories, The, 961 Frelinghuysen Ave., Newark, N. J.

Research staff: Thomas T. Gray, Frank B. Mason, F. A. Urner and 7 men.

Research work: One-fourth time of 10 on petroleum and its products.

Unusual equipment: Complete semi-commercial oil refining equipment.

126. Great Western Sugar Company, The, Sugar Building, Denver, Colo.

Research staff: W. C. Graham, 1 chief chemist, 4 chemical engineers, 4 research chemists, 2 mechanics, 1 experimental process man, 3 analysts.

Research work: Full time of 16 on investigations of fundamental principles of processes and practices now in use, examination of proposed new processes and apparatus and study of utilization of by-products and waste products; production of crude potash, sodium cyanide, ammonium sulphate and certain rare organic chemicals from the Steffen's waste water; refining of crude potash leading to production of carbonate, hydrate, etc.; production of glycerine by fermentation of waste molasses; recovery of organic acids from waste waters.

Unusual equipment: Complete equipment for manufacture of sugar on a small scale under such conditions that special attention may be paid to any stage of the process.

127. Guggenheim Bros., Chile Exploration Co. Laboratories, 202nd St. and 10th Ave., New York, N. Y.

Research staff: Colin G. Fink, 12 research engineers, 2 analytical chemists and 17 assistants and helpers.

Research work: Almost full time of 32 on metallurgical problems, in particular, electro metallurgical, smelting, leaching, flotation, electrolytic refining, recovery of by-products, insoluble anodes, etc.

Unusual equipment: $\frac{1}{4}$ ton Rennerfelt furnace; $\frac{1}{4}$ ton Snyder furnace; large electrolytic cells; 12 kw. low volt d. c. generator; complete metallographic outfit.

128. Gulf Pipe Line Company, Houston, Tex. Producers and transporters of petroleum.

Research staff: F. M. Seibert and 4 trained research men.

Research work: Full time of 5 on methods for production and transportation of oil; special problems on treatment of crude oil emulsions, conservation of oil, gas, etc.

129. Gurley, W. & L. E., 514 Fulton St., Troy, N. Y. Makers of instruments for civil, mining and hydraulic engineers, and land surveyors.

Research staff: E. W. Arms, 3 engineers, 3 mechanics and assistants as needed.

Research work: Practically full time of 7 on investigations for design and manufacture of instruments for civil, mining and hydraulic engineers, such as automatic water stage registers, current meters, hook gages, transits and levels.

Unusual equipment: For testing and calibrating standard precision measures of weight, capacity and length; for investigation of water measurements and for design of instruments for this purpose; automatic water stage registers, current meters and hook gages; special dividing engines for accurate graduation of circles; for drawing platinum wire from 0.001 to 0.0002 inch diameter for cross-wire reticles and in research experiments.

130. Hamersley M'g Co., The, Garfield, N. J. Manufactures waxed papers.

Research staff: 1 chemical engineer and 7 chemists.

Research work: One-third time of 8 on pulp paper, and paper mill chemicals.

Unusual equipment: Well equipped for general research work; also for paper mill experiments on semi-commercial scale.

131. Harbison-Walker Refractories Company, Farmers Bank Building, Pittsburgh, Pa. Manufactures fire-clay, silica, magnesite and chrome bricks and other refractory products.

Research staff: R. H. Youngman, 1 chief chemist, 1 ceramist, 1 or 2 chemists.

Research work: One-third time of 4 on problems in connection with refractories.

Unusual equipment: 1 coal and 1 gas-fired test kiln, air compressor (90 cubic feet per minute at 90 pounds per square inch) 1 motor (18 horse-power) small ore crusher, 2 Braun planetary pulverizers, 1 hydraulic press of 104 tons capacity.

132. Harrison Safety Boiler Works, Cochrane Research Laboratories, 17th St. and Allegheny Ave., Philadelphia, Pa., and Earnest, Pa.

Research staff: P. S. Lyon (engineering), J. D. Yoder (chemical), 2 chemists and 5 engineers.

Research work: Full time of 6 on treatment of boiler feed water; experiments on V-notch weirs and other flow meters; water softening; problems in the development of traps, valves, steam and oil separators, etc.

133. Heinrich Laboratories of Applied Chemistry, 1001 Oxford St., Berkeley, Cal. (ex Tacoma, Wash.).

Research staff: E. O. Heinrich and 1 chemist.

Research work: Full time of 2 on chemical and photomicrographical problems as applied to criminal investigation.

134. Hercules Powder Company, Kenvil, N. J. Manufactures explosives.

Research staff: C. F. Bierbauer and 47 chemists.

Research work: Full time of 48 on explosives, new materials, and related studies.

135. Hochstadter Laboratories, 227 Front St., New York, N. Y.

Research staff: Irving Hochstadter and 3 chemists.

Research work: One-half time of 4 on manufacture and preparation of food products with special emphasis on problems relating to drying and desiccation.

Unusual equipment: For drying food products.

136. Holz & Company, Inc., 17 Madison Ave., New York, N. Y.

Research staff: Herman A. Holz and 3 engineers (metallurgical and magnetic).

Research work: Full time of 4 on metallographic problems; correlation of magnetic and mechanical properties of steel.

Unusual equipment: Magnetic and magnetic-mechanical testing apparatus.

137. Hood Rubber Company, Watertown, Mass.

Research staff: Warren E. Glancy, 2 chemists and several routine assistants.

Research work: Small part time of staff on new methods of examination of materials; study of various organic derivatives.

Unusual equipment: Latest devices and machines for testing rubber, cloth, yarns; large experimental mill room equipped with heavier machinery and heavier testing machines for testing tires (solid, pneumatic, etc.).

138. Hooker Electrochemical Co., Niagara Falls, N. Y.

Research staff: T. L. Blyster, Director of Development, R. L. Murray, Research Manager, A. H. Hooker, Technical Director, 10 chemists and chemical engineers and 9 assistants.

Research work: Full time of 22 on development of new outlets for chlorine, betterment of present process and manufacture of small tonnage.

Unusual equipment: Furnace room and semi-commercial portion of laboratory built with removable or movable floors to adapt itself to various designs and different sizes of equipment.

139. Hoskins Manufacturing Company, 453 Lawton Ave., Detroit, Mich. Manufactures electric furnaces, pyrometers and heating appliances.

Research staff: W. A. Gatward and 4 engineers.

Research work: Almost full time of 5 on the improvement and production of alloys and allied products.

140. Howard Wheat and Flour Testing Laboratory, The, Old Colony Building, Minneapolis, Minn.

Research staff: C. H. Briggs and 3 chemists.

Research work: Small part time of 4 on problems connected with causes of peculiar variations of wheats and other cereals when baked into bread or used for other food purposes; efforts to improve methods of separation of wheat proteins; improved methods of quantitative analysis; chemical causes of loaf expansion and effects of various activating materials in bread making, carried out by cooperation of baking and chemical departments. Some work on distinguishing cereal flours one from another.

Unusual equipment: Moisture testers for grain, 4-decimeter S. and H. polarimeter, microscope-polariscope, Duboscq colorimeter, Lovibond tintometer, haemocytometer, yeast testing apparatus of special design, calorimeter, electrical measuring instruments, etc.; wheat and grain cleaning and milling department and a baking test department, equipped for handling more than 100 individual tests daily with automatic control of kneading machines, bread raising cabinets, etc.

141. Industrial Research Corporation, 1025 Front St., Toledo, Ohio.

Research staff: C. P. Brockway and 2 engineers.

Research work: Full time of 3 on problems related to small machine equipment and small devices in metal.

142. Industrial Research Laboratories, 8 So. Dearborn St., Chicago, Ill.

Research staff: F. Peter Dengler, 2 chemists and 1 engineer.

Research work: Full time of 4 on manufacturing and research problems relative to cement, coal, corn, cotton seed, drugs, dairy, dyes, foods, minerals, paints, paving, petroleum, paper, sewage, soap, steel, sugar, tobacco, water, barley, conservation of waste material.

Unusual equipment: Complete commercial equipment for decolorizing cloth, mill ends, flour bags, sugar bags and all cloth signs. Commercial equipment for extracting vegetable alkaloid from tea and coffee.

143. Industrial Testing Laboratories, 402 West 23rd St., New York, N. Y

Research staff: Emil Schlichting and several chemists.

Research work: Small part time of staff on problems connected with fermentation and food industries.

Unusual equipment: For chemical and biological analyses of food and beverages.

144. Industrial Works, Bay City, Mich.

Research staff: H. L. Campbell, 2 chemists, and 1 or more assistants.

Research work: Not over one-fifth part time of 5 on development of heat treatment of metals; properties of metals; determining stresses in machine parts; determining properties of materials; control of foundry processes; investigation of welding methods.

Unusual equipment: Shore scleroscope, Berry strain gages; 150,000 pound Riehle testing machine; metallographic outfit.

145. Inland Steel Company, Indiana Harbor, Ind.

Research staff: J. C. Dickson, 29 chemists and 5 chemical engineers.

Research work: Full time of 4 and part time of 30 on problems connected with steel industry.

Unusual equipment: Electric and gas furnaces, physical testing machines.

146. Institute of Industrial Research, The, 19th and B Sts., N. W., Washington, D. C.

Research staff: Allerton S. Cushman and chemists, physicists and assistants as needed.

Research work: Varying part time of staff on physical testing of cements, rocks, clays, brick, block, iron, steel, wood, rubber, and other materials of construction. In Bitumen Laboratory petroleum and petroleum products, tars and tar products, creosoting oils, asphalts, bituminous emulsions, bituminous aggregates, and all other types of chemical road and paving materials, roofing materials, rubber, etc., are examined and tested. Chemical examinations of rocks, clays, cements, etc., are made and researches conducted on improvements in industrial products and processes and utilization of waste products for road purposes.

Unusual equipment: For cement and bitumen.

147. International Nickel Co., The, Bayonne, N. J.

Research staff: Robert J. McKay, 1 metallurgist, 1 assistant metallurgist, 1 chemist, 1 assistant chemist, 1 laboratory assistant, 1 civil engineer, 1 machinist, 1 stenographer and 1 clerk.

Research work: Four-fifths time of 10 on metallurgy of copper and nickel, physical properties of nickel and monel metal, uses of nickel, monel metal and nickel alloys.

Unusual equipment: Laboratory electric furnace equipment for metallurgical experiments. Dust and fume sampling apparatus.

148. International Silver Company, Meriden, Conn.

Research staff: Chas. E. Skidgell and 2 chemists.

Research work: Small part time of 3 on electro-plating.

Unusual equipment: For analysis of electro-plating solutions, determination of weights of deposit and similar matters.

149. Kalmus, Comstock & Westcott, Inc., 110 Brookline Ave., Boston, Mass. Consulting and research engineers.

Research staff: Daniel F. Comstock, Physical Research, E. J. Wall, Photographic Chemistry, E. W. Westcott, Chemical Engineering, and chemists, physicists, engineers and assistants, varying from 20 to 30.

Research work: Full time of staff on chemical, electrochemical, metallurgical and photographic lines, leading to development of processes and design and construction of plants.

150. Keuffel & Esser Co., Hoboken, N. J. Manufactures drawing materials and mathematical and surveying instruments.

Research staff: Carl Keuffel, 1 chemist, 2 assistant chemists, 2 optical engineers, and 2 assistants.

Research work: One-half time of 8 on optical glass and various articles manufactured, including design of optical instruments and calculation of optical systems.

Unusual equipment: Special equipment for testing presence of small quantities of iron in silicates, and for physical, chemical and microscopic testing of papers. Optical laboratory equipped for general testing of optical instruments, transmission photometers, special optical benches.

151. Kidde, Walter, & Company, Incorporated, 140 Cedar St., New York, N. Y. Engineers and constructors. Research laboratory at Keyport, N. J., at factory of Monmouth Chemical Co., manufacturers of chlorate of potash.

Research staff: E. Schwarz, 1 chief chemist and 2 assistants.

Research work: One-fourth time of 4 on improvements in connection with plant.

152. Kilbourne & Clark Manufacturing Company, 20 West Connecticut St., Seattle, Wash. Engineers and manufacturers of electrical apparatus, principally radio telegraph.

Research staff: H. F. Jefferson and 5 men.

Research work: Time of staff as occasion requires, on testing and investigating high-frequency circuits.

Unusual equipment: Wave-meters, decimeters, sphere spark gap (25 C. M. sphere) for high voltage tests; condensers, variable and fixed, with air, mica and oil dielectrics; inductances in various forms for high and low voltage; 500-cycle meters for use in connection with audio-frequency circuits in radio work.

153. Kistler, Lesh & Company (Burke Tannery), Morganton, N. C.

Research staff: J. S. Rogers.

Research work: Part time of 1 on chemical problems connected with tanning industry.

Unusual equipment: Laboratory equipped for control and research

connected with tanneries and extract plant; contains regular equipment for leather, tanning materials and liquor analyses.

154. Klipstein, E. C., & Sons Co., So. Charleston, W. Va. Manufactures dyes.

Research staff: Dr. Cabellis and 11 chemists.

Research work: One-half time of 12 on new dyes and their intermediates.

Unusual equipment: Everything necessary for semi-commercial experimental production.

155. Kokomo Steel and Wire Co., Kokomo, Ind.

Research staff: R. K. Clifford, 2 chemists and 2 assistants.

Research work: One-third time of 5 on standardization of raw materials specifications and improvement of products in connection with manufacture of open hearth steel, wire and wire products.

Unusual equipment: Chemical laboratory for the analysis of carbon and special steels, ores, alloys and raw materials, gas, etc. Physical laboratory containing a 100,000-pound Olsen testing machine, a Brinell machine and electric furnace for heat treatments. Metallographic equipment for grinding, polishing and micro-photography. Pyrometer equipment, including Leeds Northrup optical pyrometer.

156. Kolynos Co., The, New Haven, Conn. Manufactures dental cream.

Research staff: L. A. Jenkins, 3 chemists and 2 bacteriologists.

Research work: One-half time of 6 on oral hygiene.

Unusual equipment: Chemical and bacteriological laboratories well equipped for pharmaceutical branch of chemistry.

157. Koppers, H., Company, Pittsburgh, Pa. Designers and builders of by-products coke and gas oven plants.

Research staff: F. W. Sperr, Jr., 15 men on inside work and 10 men on outside work.

Research work: Full time of 26 on problems closely related to coke ovens and by-products.

Unusual equipment: Laboratories and experimental plant fully equipped for semi-commercial tests, and plants available for large-scale tests.

158. Kraus Research Laboratories, Inc., 130 Pearl St., New York, N. Y. Consulting engineers in refractories.

Research staff: Charles E. Kraus, 2 ceramists, 2 research engineers and 2 assistants.

Research work: Three-fourths time of 7 on ceramics and refractories.

Unusual equipment: Equipped to make all standard tests on refractory materials, both in raw and finished state. High temperature furnaces.

159. Krebs Pigment and Chemical Co., The, Newport, Del.

Research staff: H. W. Fox, 2 chemical engineers, 1 chemist and 2 assistants.

Research work: Full time of 6 on properties of lithopone; efficiency of steps of process, barytes ore concentration.

160. Kullman, Salz & Co., Benicia, Cal. Tanners and curriers.

Research staff: Director to be appointed; 1 assistant chemist and 1 helper.

Research work: Variable amount of time of 3 on science of tanning.

161. Laclede-Christy Clay Products Company, 4600 S. Kingshighway, St. Louis, Mo.

Research staff: C. W. Berry and 1 assistant.

Research work: One-half time of 2 on development of refractories, superior clays for use in paper, graphite crucibles, enamels; unusual basic and neutral refractories, such as high aluminous materials, combinations of alumina and magnesia.

162. Larkin Co., 680 Seneca St., Buffalo, N. Y. Soap manufacturer.

Research staff: C. B. Morey, 5 chemists and 3 assistants.

Research work: Three-fourths time of 9 on soaps, fats and oils; development along miscellaneous lines of new products for the company.

Unusual equipment: Small experimental plant for producing soap.

163. Lederle Laboratories, 39 West 38th St., New York, N. Y.

Research staff: Herbert D. Pease and a number of chemists, bacteriologists and assistants.

Research work: Small part time of staff along sanitary, chemical and bacteriological lines.

Unusual equipment: Well equipped for chemical, bacteriological and some physical work.

164. Leeds & Northrup Company, The, 4901 Stenton Ave., Philadelphia, Pa. Makers of electrical measuring instruments.

Research staff: M. E. Leeds, 6 trained men in research work and 2 mechanics.

Research work: Large part time of 9 on development and use of apparatus for precise measurements in heat, light, electricity, and magnetism; determining projectile velocities, improving depth bombs, perfecting apparatus for submarine detection, perfecting apparatus for bomb sighting, and determining temperature control in ordnance plants.

Lewis Institute. See Structural Materials Research Laboratory.

165. Lilly, Eli, and Company, Indianapolis, Ind. Manufactures pharmaceutical and biological products.

Research staff: Frank R. Eldred and about 40 chemists and pharmacologists.

Research work: Full time of 8 men and half time of 17 directed to development of new therapeutic agents and to broad study of mode of action of drugs from physical, chemical and physiological standpoints.

166. Lincoln, E. S., Inc., 534 Congress St., Portland, Me. Consulting engineers; electrical laboratories.

Research staff: E. S. Lincoln and 3 engineers.

Research work: One-fourth time of 4 on power transmission efficiency. Field work a specialty.

167. Linde Air Products Company, Buffalo, N. Y.

Research staff: Pierre E. Haynes and 33 men.

Research work: Four-fifths time of 34 on the manufacture of industrial gases.

Unusual equipment: Complete apparatus for analysis of gaseous mixtures by fractionation absorption and gravimetric determination of gaseous density. Pressures available up to 3000 pounds per square inch. Temperatures down to 75 degrees C. absolute.

168. Lindsay Light Company, 161 E. Grand Ave., Chicago, Ill.

Research staff: H. N. McCoy, 8 chemists and 1 engineer.

Research work: Four-fifths time of 10 on improvements of processes of refining thorium nitrate, cerium compounds, organic preparations such as phenolphthalein and vanillin, preparation of dyes.

169. Little, Arthur D., Inc., 30 Charles River Road, Cambridge, Mass.

Research staff: G. J. Esselen, Jr., 18 analytical chemists, 10 research chemists and 6 chemical engineers.

Research work: Full time of 10 on paper and pulp, cellulose and its compounds, utilization of lumbering waste, naval stores, potash, soap, metallurgy, application to colloid chemistry.

Unusual equipment: Complete experimental paper mill and other semi-commercial scale equipment.

170. Littlefield Laboratories Co., Seattle, Wash.

Research staff: E. E. Littlefield, 1 electrochemist and electro-physicist, 1 chemist and 1 mechanical engineer.

Research work: Full time of 1 and part time of 3 in chemical, electrical and electrochemical fields; development of special apparatus for initiating and stopping flow of liquids by varying conductivity; electrical treatment of vegetation. Usually done in connection with large industries in the United States and England.

171. Lockhart Laboratories, 33 $\frac{1}{2}$ Auburn Ave., Atlanta, Ga.

Research staff: L. B. Lockhart.

Research work: Two-thirds time of 1 on lubricating oils and greases for automobiles, railroads, etc.; petroleum products, fixed oils, soaps, etc.; also special work on bleaching cotton.

172. Ludlum Steel Company, Watervliet, N. Y.

Research staff: P. A. E. Armstrong and 4 trained men.

Research work: Full time of 5 on improvement of manufacturing methods for ferro alloys and certain steels, such as magnet steel, and methods of chemical analysis of steels and ferro alloys.

173. Lumen Bearing Company, Buffalo, N. Y. Brass founders.

Research staff: C. H. Bierbaum, metallurgist, B. Woiski, chief chemist, and 2 assistants.

Research work: Varying portion time of 4 on problems in non-ferrous field; interested in microphotography and uncovering new data all the time.

Unusual equipment: 50,000-pound Olsen machine, Brinell machine, scleroscope, etc.

174. Lunkenheimer Co., The, Cincinnati, Ohio. Manufactures valves, pipe fittings and other metal specialties.

Research staff: George K. Elliott and 7 assistants.

Research work: Two-fifths time of 8 on metallurgical problems and corrosion. Generation and handling of saturated and super-heated steam; application of arc electric-furnace to production of malleable cast iron, special gray irons, and other high-carbon iron alloys.

175. MacAndrews & Forbes Company, 3rd St. and Jefferson Ave., Camden, N. J. Manufactures dyestuffs, wall-board and foamite fire extinguishers.

Research staff: Percy A. Houseman and 7 chemists.

Research work: Three-fourths time of 8 on licorice extract (especially glycyrrhizen), natural dyes (especially hematoxylin from logwood), wall board, box board, and Foamite fire extinguishers.

Unusual equipment: Copper extractors, percolators and vacuum pans of laboratory size and semi-commercial size.

176. Manhattan Rubber Mfg. Co., The, Passaic, N. J. Mechanical rubber goods.

Research staff: W. L. Sturtevant, 5 chemists, 5 assistant chemists and 1 engineer.

Research work: One-fourth time of 12 on rubber compounding and vulcanization.

177. Martin, Glen L., Company, The, 16800 St. Clair Ave., Cleveland, Ohio. Builders of airplanes.

Research staff: Lessiter C. Milburn, 1 metallurgical engineer and 1 chemist.

Research work: One-third time of 3 on new aircraft materials and check of aircraft designs, aircraft performance tests, and general aircraft development.

Unusual equipment: Rib testing machine (transverse loading distributed according to any pre-determined ratio). Two combined pendulum tension machine and impact test machine, with interchangeable hammers (pendulums) and two ranges of capacity (200 and 1000 pounds).

178. Martinez Refinery, Shell Co. of California, Martinez, Cal.

Research staff: A. W. Jurrissen and 2 chemists.

Research work: Varying portion time of 3 on treatment and production of petroleum products.

Unusual equipment: Large scale cracking apparatus and treating plant.

179. Marvin-Davis Laboratories, Incorporated, 85 Ninth Ave., New York, N. Y. These are the laboratories of the National Biscuit Company, formerly its Division of Dietetics and Research.

Research staff: Clarke E. Davis, 4 chemists, 2 engineers, 1 baker and 1 assistant.

Research work: One-half time of 9 on food products, their packing and distribution.

180. Mathieson Alkali Works, (Inc.), The, Niagara Falls, N. Y.

Research staff: Ralph E. Gegenheimer, 6 chemists and 3 assistants.

Research work: Full time of 4 on chlorination processes, uses for new chlorine products, plant problems in connection with Castner process.

181. Maynard, T. Poole, Atlanta, Ga. Geological and industrial engineering.

Research staff: T. Poole Maynard, 1 chemical engineer, 1 mining engineer and 1 civil engineer.

Research work: One-third time of 4 on clays, textiles, oil-cloth; recovery of potash from silicates.

182. Medina Gas & Fuel Co., Cor. Market & North Sts., Wooster, Ohio. Connected with Dominion Natural Gas Co., Ltd., Buffalo, N. Y. Devoted to production and utilization of artificial and natural gas and petroleum.

Research staff: W. G. Leamon and 6 assistants.

Research work: Full time of 7 on gases and oils; new large-scale method of removing hydrogen sulphide from fuel gases; paving asphalt from Mexican petroleum without use of natural asphalts; improvements in absorption methods of extracting natural gas gasoline; vapor pressure phenomena of mixtures of hydrocarbons as found in natural gas gasoline and effects of blending with higher-boiling oils; methods of extracting oil from oil shales; simplifying laboratory practices; volumetric method of technical water analysis; simplified method of technical gas analysis; improved method of determining gasoline content of laboratory-size gas samples.

183. Mellon Institute of Industrial Research and School of Specific Industries, University of Pittsburgh, Pittsburgh, Pa.

Research staff: Raymond F. Bacon, 1 associate director, 4 assistant directors, and head of department of research in pure chemistry. Has about 45 industrial fellowships and 65 fellows. Six national trade associations, with a membership of over two thousand firms, have fellowships in the Institute.

Research work: Full time of staff along chemical and engineering lines, more especially chemical.

Unusual equipment: One of the best equipped laboratories in the country, together with outside experimental plants.

184. Merck & Co., 45 Park Place, New York, N. Y. Manufacturing chemists.

Research staff: B. L. Murray and 4 trained chemists.

Research work: Full time of 5 on problems incident to manufacture of the company's products.

Unusual equipment: Standard equipment for research in connection with manufacture of medicinal, analytical, photographic and technical chemicals.

185. Merrell-Soule Laboratory, Syracuse, N. Y.

Research staff: R. S. Fleming, 4 chemists and 3 assistants. An engineering department which does much work which might be classified as research.

Research work: Half time of 8 on food problems.

Unusual equipment: Experimental drying plant.

186. Merrimac Chemical Co., North Woburn, Mass.

Research staff: Lester A. Pratt and 5 chemists.

Research work: Full time of 6 on sulphuric, nitric and hydrochloric acids, and inorganic chemicals.

Unusual equipment: Industrial laboratory for carrying on large scale experiments.

187. Metal & Thermit Corporation, 120 Broadway, New York, N. Y. Laboratory at Jersey City, N. J.

Research staff: A research council, holding weekly conferences, 1 engineer, 2 supervising chemists, 3 analytical chemists.

Research work: Full time of 6 perfecting processes for the production of rare metals, alloys for industries using ferro-alloys and non-ferrous-alloys, etc.

188. Metz, H. A., Laboratories, Inc., 122 Hudson St., New York, N. Y.

Research staff: Gustave P. Metz and 6 chemists.

Research work: Studies of chemical, pharmaceutical and biological products; dyestuffs and intermediates relating to manufacture of dyestuffs.

Unusual equipment: Chemical apparatus for pharmaceutical, biological, dye and color work.

189. Midvale Steel Company, The, Midvale Works, Nicetown, Philadelphia, Pa.

Research staff: A. H. Miller and 17 men.

Research work: One-half time of 18 on investigation of properties of steel, including the establishing of equilibrium diagrams of a number of steel alloys; also investigation of new alloys of steel for use as cutting tools, as ordnance material, and as steel of high tensile characteristics.

Unusual equipment: Apparatus for several methods of obtaining critical temperatures, shock testing machines of Charpy and Izod types, Brinell and Shore hardness testing apparatus, potentiometers and galvanometers used in temperature measurements through the agency of thermocouples; and experimental heat treatment furnaces of both gas and electric types. Research Department also has access to chemical laboratory and testing room, as well as all melting, forging, heat-treating, and machining facilities of plant.

190. Miller Rubber Co., The, Akron, Ohio. Manufactures tires and other rubber goods.

Research staff: M. M. Harrison and 5 chemists.

Research work: Full time of 6 on rubber and organic chemistry.

Unusual equipment: Scott fabric tester, Curtis & Marbel fabric inspecting apparatus, tire testing apparatus, etc.; compounding laboratory mill and calendar, experimental press, etc.

191. Milwaukee Coke & Gas Company, The, 1st National Bank Building, Milwaukee, Wis.

Research staff: George H. Selke and a number of chemists.

Research work: Full time of 1 to increase efficiency of by-product coke plant; includes heating of ovens, and recovery of light oil, ammonia, gas, etc.

192. Minneapolis Steel and Machinery Co., Minnehaha Ave. & 29th St., Minneapolis, Minn.

Research staff: J. Roy Hoven, chief chemist, 2 chemists, 1 assistant; C. S. Moody, metallurgical engineer, 3 assistants.

Research work: One-fourth time of 8 along the lines of research of steel with exception of melting.

Unusual equipment: 100,000-pound automatic autographic Olsen testing machine, Brinell hardness machine, small electric furnace for temperature up to 1800 degrees F., Leeds and Northrup potentiometer, Leeds and Northrup optical pyrometer, metallographical equipment, Riehle transverse testing machines.

193. Mojonnier Bros. Co., 739 W. Jackson Boulevard, Chicago, Ill. Scientific dairy apparatus and supplies; milk testing.

Research staff: Timothy Mojonnier and J. J. Mojonnier, 1 analyst, 3 chemists and 2 chemists and bacteriologists.

Research work: One-tenth time of 8 on scientific control of milk and milk products, particularly in evaporated and condensed plants,

ice-cream plants and large dairies. Effect of preservatives on composite milk samples; culture, propagation, etc.

Unusual equipment: Mojonnier Model D Milk Tester, containing rapid cooling desiccators; the Mojonnier Model E Culture Controller for the continual propagation and control of pure lactic cultures; sediment tester, acidity and salt tester.

194. Monsanto Chemical Works, 1800 South 2nd St., St. Louis, Mo. Manufactures fine and medicinal chemicals, sulphuric and other technical acids, phenol and other heavy chemicals.

Research staff: Jules Bebie, 30 chemists, 4 engineers and 1 safety engineer.

Research work: Full time of 5 or 6 chemists on subjects related to synthetic pharmaceuticals and fine chemicals, including intermediates.

Unusual equipment: Semi-commercial scale experimental laboratory with tanks, stills, agitating kettles, filter press, etc.

195. Morrill, Geo. H., Co., Norwood, Mass. Manufactures printing and lithographic inks, varnish and dry color.

Research staff: Olney P. Anthony and 3 chemists.

Research work: Full time of 4 on dye research.

Unusual equipment: Dye experimental apparatus.

196. Morris & Company, Union Stock Yards, Chicago, Ill.

Research staff: J. J. Vollertsen, 2 chemical engineers, 1 chemist and 1 bacteriologist.

Research work: Full time of 5 on industrial investigations of packing house problems and by-products.

197. Mulford, H. K., Company, Biological Laboratories, Glenolden, Pa. Manufacturing and biological chemists.

Research staff: John Reichel and 9 persons; in addition, dozens of staff and laboratory assistants engage in some research.

Research work: One-third time of 10 and part time of laboratory staff on problems connected with pharmacology, bacteriology, immunology and serology.

Unusual equipment: Specially equipped for dealing with problems relating to pharmaceutical, biological, biological agricultural work and chemistry of soil, and for bacteriological and serological work. Stock culture department has more than a thousand strains of all bacteria used.

198. Musher and Company, Incorporated, Baltimore, Md. Formerly The Pompeian Co.

Research staff: Eugene Bloomberg, 2 chemists and 1 assistant.

Research work: Full time of 4 along general lines of food products with special attention to expression, care and utilization of vegetable oils.

Unusual equipment: Small scale food manufacturing operations, such as expression and filtration of oils.

199. National Aniline & Chemical Company, Inc., 21 Burling Slip, New York, N. Y.

Laboratories at Buffalo and Brooklyn, N. Y. and Marcus Hook, Pa.

Marcus Hook Laboratory, Marcus Hook, Pa.

Research staff: L. P. Kyrides and 9 chemists.

Research work: Almost entirely on dyes and intermediates.

Data concerning the Buffalo and Brooklyn laboratories not received in time for printing.

National Biscuit Company. See Marvin-Davis Laboratories, Inc.

200. National Canners Association, 1739 H. St., N. W., Washington, D. C.

Research staff: W. D. Bigelow and 7 chemists, some trained in physics and one in bacteriology.

Research work: One-half to two-thirds time of 8 on study of tin plate from all standpoints; study of causes of spoilage; defective cans; improper management of sealing machine; insufficient temperature or time of sterilization; influence of character of product on penetration of heat to center of can. Study of micro-organisms causing spoilage; abnormal colors on inside surfaces of containers or in contents; conditions leading to rusting or perforation of containers; influence of hard water on hardness or toughness of certain canned vegetables and study of conditions where softening systems would be advisable. Study of waste products, of efficiency of canning devices and operations, especially the conserving of heat. Some of the most effective work has been done in collaboration with other organizations.

Unusual equipment: Special canning equipment with laboratory facilities. Experimental small factory scale cannery and canning laboratory.

201. National Carbon Company, Inc., Cleveland, Ohio. Has two research and development laboratories, one at Cleveland, the other in Fremont, Ohio.

Research staff: H. D. Batchelor; each laboratory has a staff of more than 20 technical men, including chemists, chemical engineers, electrical engineers and physicists.

Research work: Full time of staff on chemical, electrochemical, electrical and physical problems related to company's products.

Unusual equipment: For research and development work connected with manufacture of dry batteries, storage batteries, carbons for electric arc lights, carbon brushes for generators and motors.

202. National Gum & Mica Co., 59th St. and 11th Ave., New York, N. Y.

Research staff: Jerome and Walter Alexander, 3 chemists, 1 chemical engineer and 1 assistant.

Research work: Four-fifths time of 7 on adhesives, colloids, gums, starches, colors, sizings, finishings, etc., for paper and textiles.

203. National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio. Nela Research Laboratory.

Research staff: Edward P. Hyde, 6 physicists, 1 physiologist, 1 psychologist, 1 mechanic, 1 lamp maker, 1 engineer, 6 assistants and 3 clerks. Outside investigators invited to work in the laboratories; sometimes there have been as many as 7. Charles F. Brush Fellowship in physics.

Research work: Nearly full time of 21 on physics, physiology and psychology of light, particularly in those phases of these sciences which pertain to the science of illumination. Problems to be investigated

group themselves roughly into three classes: 1. Those which have to do with the production of luminous energy; 2. Those which have to do with the utilization of luminous energy; and 3. Those which have to do with the effects of luminous and attendant radiation. Under the first class comes the investigation of the laws of radiation and of the radiating properties of matter. The problems in this class are purely physical. Under the third class comes the investigation of the effects of light and of the attendant radiation on the eye, on the skin, and on microscopic organisms, and of those more subtle but equally important effects of light on our mental phenomena, such as attention, memory and the emotions. Problems of the second class have to do with the absorbing, reflecting, and diffusing properties of matter, the measurement of light, *i. e.*, photometry, and the study of the complex phenomena of color and color sensation. The division having to do with these problems comes into closest contact with illuminating engineering practice. Records of researches are published as papers before the scientific and technical societies and as contributions to the technical journals. Illustrated abstracts of these papers, prepared by the authors, are collected in the Abstract-Bulletin, published by the laboratory.

Glass Development Laboratory.

Research staff: Edward P. Hyde and 5 technical men.

Research work: One-half time of 6 on development work on glass used in connection with the manufacturing of incandescent electric lamps.

Unusual equipment: High-temperature furnace room with both gas and electric furnaces; a physical and optical room with polariscopes, microscopes, spectrometer and other physical apparatus for testing and measuring the mechanical and optical properties of glass.

204. National Lead Company, 129 York Street, Brooklyn, N. Y.

Research staff: Gustave W. Thompson, 1 chief chemist, 4 assistants, 9 special investigators and head analysts, 2 paint experts, 8 assistant analysts, 5 laboratory helpers, 6 clerks.

Research work: One-half time of 36 on metals and their products.

Unusual equipment: Howland photometer, complete system identifying all colors on geometric basis; Thompson classifier, for classification of particles of pigments, etc.; special revolving disc apparatus, for measuring strength of whiteness of pigments; special opacimeter for study of opacity of paint films; complete storage battery installation; viscosimeter for oils, automatic recording instrument for cooling curves of alloys; differential cooling curve apparatus; Swedish Brinell Hardness Testing Machine, arrangement for making Baby Brinell hardness tests; Shore scleroscope; Sharples high speed centrifuge; ozone generator; special electric furnaces, etc.

205. National Tube Company, Frick Building, Pittsburgh, Pa. Manufactures steel and iron tubes and pipes.

Research staff: F. N. Speller and 6 to 8 men.

Research work: Full time of staff on corrosion of iron and steel under water.

Unusual equipment: Metallographic apparatus and physical testing machines of all kinds.

Nela Research Laboratory. See National Lamp Works of General Electric Co.

206. Nestlé's Food Company, Incorporated, 130 William St., New York, N. Y. Manufactures condensed milk.

Research staff: G. A. Menge, 1 bacteriologist and micologist, 1 chemist and 2 assistants.

Research work: One-half time of 5 on sweetened or unsweetened condensed milk and other products that company produces or may produce.

Unusual equipment: Experimental equipment for production of condensed and evaporated milk; also special analytical and biological equipment adapted to problems pertaining to this industry.

207. New England Confectionery Company, 253 Summer St., Boston, Mass.

Research staff: Edmund Clark and 1 chemist.

Research work: Nine-tenths time of 2 on problems connected with the industry.

208. New Jersey Zinc Company, The, 55 Wall St., New York, N. Y.

Research staff: J. A. Singmaster, 25 chemists, 5 physicists and 50 assistants.

Research work: Full time of 81 on chemical and physical investigations connected with metallurgy of zinc, manufacture and utilization of sulphuric acid and production and properties of worked metallic zinc in shape of sheets, rods, tubes, etc.; also manufacture and use of zinc oxide in rubber and paint industries.

Newlands Laboratories. Organic and sanitary department of The Henry Souther Engineering Co.

209. Newport Turpentine & Rosin Company of Florida, Pensacola, Fla.

Research staff: R. C. Palmer and 2 assistants.

Research work: One-fifth time of 3 on problems relating to the technical and industrial development of terpene and terpene products.

210. Niagara Alkali Co., Niagara Falls, N. Y. Manufactures caustic potash, caustic soda, chlorine products.

Research staff: V. Kokatnur, 1 chief chemist, 2 chemists and 2 assistants.

Research work: Full time of 6 on problems connected with utilization of chlorine; also some fundamental research bearing on main problems.

Unusual equipment: Mercury arc lamp, arc lamp and electric furnace, other electrical equipment; also semi-commercial scale plant.

211. Nichols Laboratories, The, 519 Market St., Knoxville, Tenn. Analytical and industrial chemists and chemical engineers.

Research staff: M. F. Nichols and 1 chemical engineer.

Research work: One-half time of 2 on ores, coals, tanning materials of all kinds, leathers and leather products.

Unusual equipment: Power mills, crushers, pulverizers, electric oven, assay and analytical balances, calorimeter, tintometer, extractors and mechanical shakers.

212. Northwestern Chemical Co., The, Marietta, Ohio. Manufactures chemical automobile utilities.

Research staff: A. S. Isaacs and 2 advisors.

Research work: One-half time of 1 on problems incident to automobile trade and news ink trade; anti-freezing solutions, cements, polishes, dressings and enamels, printers' ink, oil and carbon black.

213. Norton Company, Worcester, Mass. Manufactures abrasives and grinding machines.

Research staff: Ross C. Purdy; Analytical Division, 2 chemists and 2 assistants; Ceramic Division, 2 ceramic engineers and 6 or 7 assistants; Organic Division, 1 chemist, 1 expert in plastics and 2 assistants; 1 petrographer; Mechanical Division, 8 mechanical and electrical engineers; Kiln Inspection and Burning Division, 2 men experienced in uses and care of recording pyrometers and 3 assistants.

Research work: Two-fifths time of 31 on investigations of raw materials such as clay, coal, shellac, rubber, oils, paraffins, silicate of soda and abrasives, both natural and artificial; special attention to fire clay and special refractories.

Unusual equipment: Particularly well equipped to do all kinds of work in ceramic research and organic work pertaining to rubber and shellac as binding agents.

214. Nowak Chemical Laboratories, 518 Chemical Building, St. Louis, Mo.

Research staff: C. A. Nowak.

Research work: Small part time of 1 on developing new products which can be manufactured without much additional equipment in breweries.

Unusual equipment: Well equipped for brewery and other beverage and food work.

215. Packard Motor Car Company, Detroit, Mich. Engineering laboratory.

Research staff: L. M. Woolson, 3 engineers and 1 chemist.

Research work: Full time of 5 on problems connected with Liberty motor, motor trucks and automobiles; automobile and truck chassis development.

Unusual equipment: Complete dynamometer equipment for testing truck, car and airplane engines up to 500 H. P. Complete bench testing equipment for all car, truck and airplane accessories. Automotive power plant and accessories.

216. Page, Carl M., 326 River St., Chicago, Ill. Commercial research and experimental laboratories.

Research staff: Carl M. Page and several chemists, physicists and other assistants.

Research work: Full time of director and part time of others on physical, chemical and metallurgical problems; rubber.

Unusual equipment: Apparatus for work on phenomena of high-potential discharges and vacuum tubes; includes 16-plate static machine 36-inch diameter, one 18-inch and one 10-inch spark X-ray coils with electrolytic and mercury turbine interrupters, one 20,000-volt alternating current transformer with rotary converter, vacuum tube oven, assortment of special tubes, Gaede mercurial air-pump for high vacuum with a Geryk oil-pump as auxiliary. Large special arc lamps for ultra-violet rays; apparatus for work in molecular transformations of hydrocarbon oils; turbine-driven Sharples super-centrifuge, with many accessories of own design; small shop for making special apparatus.

217. Pantasote Leather Company, The, Passaic, N. J.

Research staff: Edgar Josephson.

Research work: Full time of 1 on coatings for textiles, rubber coatings for fabrics, oils, paints, varnishes and all closely related industries.

218. Parke, Davis & Company, Detroit, Mich. Manufactures drugs and medicines.

Research staff: J. M. Francis, 8 research chemists, 6 chemists on technical tests of materials, 6 pharmacists, several bacteriologists, botanists, pharmacologists, and other specialists and assistants.

Research work: Considerable portion of time of 40 on chemistry, pharmacy, bacteriology, and pharmacology, looking to continued improvement of medicinal products, and problems closely related to development of new remedial agents.

219. Patton Paint Company, Milwaukee, Wis. Plants and laboratories at Milwaukee, Wis., and Newark, N. J. Pitcairn Varnish Company and Corona Chemical Company, both of Milwaukee, are affiliated.

Research staff: A. H. Woltersdorf, Milwaukee laboratory, T. R. Collins, with 2 assistant chemists, Newark laboratory; B. L. Solomon, Pitcairn Varnish Co.; C. B. Dickey, with 2 assistants, Corona Chemical Co.

Research work: Part time of 8 on problems connected with the paint and varnish industry.

220. Peerless Color Company, Bound Brook, N. J.

Research staff: R. W. Cornelison and 2 chemists.

Research work: Part time of 3 on problems dealing directly with the manufacture of dyestuffs.

221. Pennsylvania Railroad Company, The, Altoona, Pa.

Research work: Small part time of staff on investigation of cause of failure of steel rails; locomotive design; much work in preparation of specifications for various materials; general field of lubrication; water treatment and purification; paints and preservatives; heat treatment of metals, etc. Investigation of electrolysis in systems of underground metallic structures; tests and investigations of the construction of various makes of transformers; tests of various makes of primary and secondary battery cells; oscillographic tests for linear and angular velocity, wave forms, etc.; investigations of special cases of electrical troubles; development of an electrical method of measuring the hardness and homogeneity of steel. Tests of locomotives on the road or tests of equipment with special devices; tonnage rating of trains and following up of all experimental appliances which are put into service for tests purposes. Methods for determination of elements in plain-carbon steels, alloy steels and non-ferrous alloys used for bearing backs and linings, packing-ring metal for different purposes, etc. Examination of fuels, development of specifications for paint products, lubricating and burning oils, boiler compounds, lacquers, plush, car cleaners, cutting compounds, belt dressing, polishing compounds, hydraulic-jack liquids, fuses, track caps, fire-extinguishing preparations, the recovery of used or wasted products, etc.

Unusual equipment: Physical laboratory, six universal tension and compression testing machines, one of 1,000,000, two of 300,000, two of 100,000-pound and one of 150,000-pound capacity; one vibratory

endurance spring testing machine of 75,000-pound capacity; one 43-foot drop-testing machine; two vibrating staybolt testing machines; one Brinell hardness testing machine; one 2000-pound cement testing machine; metallographic equipment.

In the machine room, where sample test specimens are prepared, the following tools are used; two 14-inch engine lathes; one 12-inch drilling lathe; one 24-inch shaper; one 24-inch radial drill; two milling machines for specimens; one 30-inch cold saw; two motor hack saws; two tool grinders; for work in testing air-brake, signal and tank hose and other miscellaneous tests, including steam and hydraulic gages, there are: Six rubber stretching machines; one friction test rack for rubber; one hose mounting machine; one vibrating test rack for hose; one continuous test rack for rubber; four tension testing machines for rubber; one stretching machine for rubber insulation; one spring micrometer machine; one vacuum gage testing machine; one arbor press specimen cutter; one hydraulic gage testing machine, capacity 25,000 pounds per square inch; one dead-weight gage testing machine, capacity six gages; one wiggling testing machine for hose; one bumping testing machine for gages; one whipping testing machine for gages; one hydraulic machine for testing gage glasses.

Rubber, air-brake hose and miscellaneous laboratory, machines for air-brake, signal and tank hose, and other miscellaneous tests, including steam and hydraulic gages, and gage glasses for boilers and lubricators.

Electrical laboratory, equipment for lamp tests consisting of three photometers, lamp test rack of 1000 lamps capacity, with switchboard, transformers and potential regulator equipment.

Manufacturing laboratory for new products, heat treatment laboratory, bacteriology laboratory for water and disinfectants, chemical laboratory.

222. Pennsylvania Salt Manufacturing Co., Greenwich Point, Philadelphia, Pa. Manufacturing chemists and importers of kryolith.

Research staff: A. E. Gibbs, 2 chemical engineers and 3 chemists.

Research work: Practically full time of 6 on problems connected with the industry.

223. Permutit Company, The, 440 Fourth Ave., New York, N. Y. Water rectification systems. Factory at Brooklyn, N. Y.

Research staff: T. R. Duggan, 7 chemists and 4 chemical engineers.

Research work: Full time of 2 entirely in connection with water problems and the use and manufacture of artificial zeolites.

224. Pfaudler Co., The, Rochester, N. Y.

Research staff: O. I. Chormann, W. F. Zimmerli, 2 chemists, 1 metallurgist and 2 helpers.

Research work: Three-fourths time of 7 on enamels for steel and cast iron; packings; resistivity of enamels, etc.

Unusual equipment: New modern laboratory completely equipped for type of work.

225. Pfister & Vogel Leather Co., 447 Virginia St., Milwaukee, Wis. Tanners and curriers.

Research staff: Louis E. Levi, 3 research chemists and 7 other chemists.

Research work: Full time of 4 on problems related to leather, glue, hair, gelatine, retarder, bitumen, paints, etc.

226. Phelps Dodge Corporation, 99 John St., New York, N. Y. Copper producers.

Research staff: G. D. Van Arsdale, 3 assistants, 1 stenographer and statistical clerk, and 1 laboratory helper.

Research work: Full time of 6 with special attention to leaching, electrolysis, flotation and slag losses of copper.

Unusual equipment: Microphotographic; laboratory-scale flotation and preliminary grinding machines; apparatus and power supply for small-scale leaching and electrolytic tests, etc.

227. Philadelphia Quartz Company, Philadelphia, Pa. Manufactures silicate of soda.

Research staff: James G. Vail, 4 chemists and 1 assistant.

Research work: One-half time of 6 on problems involving application or manufacture of silicate of soda, study of its properties as an adhesive, as an ingredient of acid-proof cement, grinding wheels, soap, asbestos insulating material, coating materials for paper and wooden packages, to prevent the absorption of grease, as an agent in refining of vegetable oils, etc.

Unusual equipment: Crushing and grinding apparatus; two gas-heated furnaces for experiments with fusion, one a small open hearth, and the other a crucible furnace; apparatus for fusion, testing of adhesives, cement, etc., and devices for making the usual commercial tests on paper; small and semi-commercial autoclaves.

Pitcairn Varnish Company. See Patton Paint Company.

228. Pittsburgh Testing Laboratory, 612 Grant St., Pittsburgh, Pa. Laboratories also in New York, N. Y., Detroit, Mich., Birmingham, Ala. and Cincinnati, Ohio.

Research staff: Jas. O. Handy, 26 chemists in Pittsburgh, 2 in New York, 2 in Detroit, 3 in Birmingham and 1 in Cincinnati; 3 mechanical and 3 civil engineers.

Research work: Variable amount time of 41 on wood and drugs (alcohol substitutes, etc.), oil refining (lubricating oil recovery), corrosion resisting metals, water purification, metal extraction from ores, refractory materials (basic).

Unusual equipment: Furnaces, special metallographic equipment, coal distillation apparatus (to be installed), testing machines.

Pompeian Company, The. See Musher and Company, Inc.

229. Portage Rubber Co., The, Barberton, Ohio.

Research staff: R. M. Gage and 2 chemists.

Research work: One-half time of 3 on testing and compounding for rubber goods.

Portland Cement Association. See Structural Materials Research Laboratory.

230. Powers-Weightman-Rosengarten Company, The, 916 Parrish St., Philadelphia, Pa. Manufacturing chemists.

Research staff: George D. Rosengarten and varying number of assistants.

Research work: Variable amount time of staff on improvement of present processes and investigation of new processes.

231. Prest-O-Lite Co., Inc., The, Indianapolis, Ind. Manufactures storage batteries; deep drawn seamless steel shells and cylinders; dissolved acetylene for lighting, welding and cutting.

Research staff: J. H. Naiden, 2 trained research workers and 10 laboratory workers.

Research work: Practically full time of 3 on problems connected with the industry, chiefly relating to storage batteries.

Unusual equipment: Motor-generator set; alternating-current equipment for testing electrical machinery; well equipped with portable electrical apparatus; battery experimental room; 2-ton ice machine for cooling box 20 x 10 x 10 feet at 60 degrees F. continuously; storage battery research room.

232. Providence Gas Company, Providence, R. I. Manufacturing Department.

Research staff: C. E. Littell, 1 assistant chemist and 3 minor chemists.

Research work: Small part time of 5 on recovery of sulphur from spent oxide, manufacture cyanogen compounds, ammonia compounds, toluol extraction, by-product producers, vertical retort operation and demulsifying tar.

Unusual equipment: Complete apparatus for calorimetry of industrial gases; analyses of gases, coal and coke; investigations on all operating details of gas manufacturing and complete apparatus for investigations of benzol and toluol.

233. Raritan Copper Works, Perth Amboy, N. J. Research Department.

Research staff: S. Skowronski, 3 chemists and 1 physicist.

Research work: Full time of 5 on copper metallurgy, electrolytic refining of copper, and recovery of by-products, gold, silver, platinum, palladium, selenium, tellurium, arsenic, nickel, antimony.

234. Redlands Fruit Products Company, Redlands, Cal.

Research staff: H. P. D. Kingsbury and 1 chemist.

Research work: Small part time of 2 on fruit products, for example, bottling orange juice.

235. Redmanol Chemical Products Co., 636 West 22nd St., Chicago, Ill. Manufactures acid- and heat-proof varnishes and lacquers, synthetic amber, moulding compounds; for electrical insulation and other uses.

Research staff: L. V. Redman, 5 chemists and 4 engineers.

Research work: One-fourth time of 10 on investigations of insulation plastics, synthetic amber and similar compounds.

236. Reliance Aniline & Chemical Co., Incorporated, Poughkeepsie, N. Y.

Research staff: Philip Kaplan and 1 chemist.

Research work: One-third time of 2 along lines of synthetic dyes.

237. Remington Arms, United Metallic Cartridge Company, Barnum Ave., Bridgeport, Conn. Research Division.

Research staff: Walter R. Hibbard, 5 chemists, 3 assistant chemists, 1 metallographist, 1 assistant metallographist, 1 pyrometer expert, 2 engineers, 11 miscellaneous.

Research work: One-eighth time of 25 on small arms ammunition.

Unusual equipment: Chemical and metallographic laboratory well equipped for steel treatment, pyrometer testing and calibration, physical testing, etc.

238. Roessler & Hasslacher Chemical Company, The, Perth Amboy, N. J.

Research staff: H. R. Carveth and 14 trained research men.

Research work: One-tenth time of 15 on electrolytic processes, including electroplating, manufacture of sodium cyanide and other cyanides, manufacture of peroxides and persalts; bleaching and finishing of textiles; chlorination of organic compounds; manufacture of formaldehyde and its compounds; precious metals, especially gold and platinum; ceramic materials.

239. Royster, F. S., Guano Company, Norfolk, Va.

Research staff: E. W. Magruder and 3 chemists.

Research work: Small part time of 4 on fertilizer problems entirely, such as cause of hardening of acid phosphate, effects of different materials on each other when mixed, etc.

Unusual equipment: Excellently equipped for fertilizer work.

240. Rubber Trade Laboratory, 325 Academy St., Newark, N. J. An advisory organization, conducting research in industrial establishments; no equipment maintained separately.

Research staff: Frederic Dannerth and 2 chemists.

Research work: One-sixth time of 3 on investigations of new materials used in rubber compounding; industrial researches for developing new materials, new processes and new machinery.

241. Rumford Chemical Works, Providence, R. I. Manufacture baking powder, yeast, bread preparation, phosphatic baking acid, acid phosphate and similar products.

Research staff: Augustus H. Fiske, 2 assistant chemists and 5 assistants, 1 librarian and stenographer and 1 miscellaneous worker.

Research work: Equivalent to two-thirds time of 1 on improvement of apparatus for manufacture of phosphoric acid and its salts; improvement of processes of manufacture and of methods of testing products in laboratory.

Unusual equipment: Gas-measuring devices for testing baking powder and specially designed electrolytical apparatus for determination of material by electrolysis.

242. Sangamo Electric Company, Springfield, Ill.

Research staff: J. W. Bard, 1 chemist, 2 assistants, 1 electrical engineer and 2 model-makers.

Research work: One-third time of 7 on properties of magnet steels; endurance of material and precious stones used as bearings; paints, varnishes, insulations, brass and steel; development of apparatus employing new principles of operation.

243. Schoenhofen, Peter, Brewing Company, The, Chicago, Ill.

Research staff: Henry W. Denny and 3 to 6 chemists, most of whom have had special training along biological lines.

Research work: One-half time of staff on food chemistry; general research in organic chemistry.

Unusual equipment: In control and research laboratories, for food-stuff investigation, both chemical and biological; digesters for high pressure work; Stokes vacuum shelf dryer; Sharples super-centrifuge, air-driven; grinding apparatus; electrically heated and controlled water

baths; Hoskins' electric muffle; Schmidt & Haensch polarimeter (Landolt type); Kober colorimeter-nephelometer, etc. Experimental plant comprises four copper vessels, each of about 150 gallons capacity provided with steam jackets, agitators and the like; also a large cereal grinder; Sperry filter press with montejus; several centrifugal pumps; carbonators; bottling machine; two cold-storage rooms, each 10 x 20 feet

244. Schwarz Laboratories, 200 Worth St., New York, N. Y. Food analyses and research; applied refrigeration; testing of fuels and lubricants.

Research staff: Robert Schwarz, 5 chemists, 1 consulting mechanical engineer and 2 assistants.

Research work: One-fifth time of 9 on food and beverage problems, both chemical and biological.

Unusual equipment: Besides laboratories, a model brewery consisting of grain hoppers, grain mill, pressure cooker of 120 gallons capacity, mixing tub of 120 gallons capacity, two copper kettles, small vacuum evaporator for extraction, and vacuum concentration problems.

245. Scientific Instrument and Electrical Machine Company, The, 500 S. York and 221 West Coover Sts., Mechanicsburg, Pa.

Research staff: W. W. Strong and 1 or 2 skilled men.

Research work: Practically full time of 3 on ionization of gases, precipitation of fumes, deblooming oil, nitrogen fixation, diamond surfaced glass, smoke and fume recorders and masks, etc.

Unusual equipment: High voltage apparatus, gratings, ultra-violet apparatus, etc.

246. Scott, Ernest, & Company, Fall River, Mass. Engineers, manufacturers of apparatus for saving industrial wastes.

Research staff: H. Austin and Robert W. Macgregor, 4 chemical engineers.

Research work: One-tenth time of 6 on vacuum evaporation, vacuum distilling and solvent extraction.

247. Scovill Manufacturing Company, Waterbury, Conn. Manufactures all varieties of brass, bronze, and German silver.

Research staff: Research committee, consisting of D. L. Summey, Chairman, R. S. Sperry and W. B. Price; 1 brass metallurgist with 6 technically trained assistants; 1 steel metallurgist with several technically trained assistants; 1 chief chemist with 50 assistants; superintendent of electrical department and assistants; 1 director of records and statistics for research department with 12 assistants; 1 man in charge of plating and brass finishing, with 2 assistants.

Research work: Full time of about 12 and part time of about 70 on metallurgy of brass, cupro nickel and steel; electric furnace, welding and electrochemical problems; metal finishing; and waste salvage. Much research work is done in the factory, using the large facilities of a plant with 14,000 hands engaged on a great variety of work.

Unusual equipment: Complete metallographic and microscopic apparatus.

Analytical laboratory, electrolytic cabinet, containing 220 positions; capacity of board 2000 assays of copper and lead per 24 hours.

Physical testing apparatus, Olsen 100,000-pound universal automatic

and autographic testing machine, 3-screw type, motor drive, speed 0.025 inch to 6.50 inches a minute; Olsen 50,000-pound universal automatic and autographic testing machine similar to the 100,000-pound machine; Olsen 200,000-pound universal automatic testing machine; Riehle 2,000-pound testing machine, hand drive for tensile tests only; Olsen Brinell hardness testing machine, capacity 3,000 kilograms pressure; Olsen and Erichsen sheet metal testers, for ascertaining ductility; Shore scleroscope.

Electrical laboratory, precision potentiometer and conductivity test set, oscillograph, recording and indicating resistance thermometers and pyrometers.

248. Sears, Roebuck and Co., Chicago, Ill.

Research staff: Don M. Nelson, 14 chemists, 6 laboratory helpers, stenographers and other help.

Research work: Small part time of staff on factory problems and standardization of merchandise.

Semet-Solvay Company. See Solvay Process Co.

Shell Co. of California. See Martinez Refinery.

249. Solvay Process Company, The, and Semet-Solvay Company, Syracuse, N. Y. Manufacturers of alkali, coke and its by-products. Do research work also for By-Products Coke Corporation, South Chicago, Ill.

Research staff: The Solvay Process Co., Carl Sundstrom, 10 chemists, 5 chemical assistants, 5 clerks and mechanics. Semet-Solvay Co., A. C. Houghton, 22 chemists, 1 chemical engineer, 2 electro-chemical engineers and 12 chemical assistants and routine men.

Research work: Four-fifths time of 20 and one-half time of 37 on soda ash, caustic soda, bicarbonate of soda, lime and limestone, cement, waste disposal, metal corrosion, new alkali products; potash, indigo, fixation of nitrogen, coal, light oils, causticizing, oxalic acid, sulphonation of benzol, picric acid, salicylic acid, chlorination of toluol, benzaldehyde, benzoic acid, and new products, such as diphenyl oxide, benzyl acetate, benzyl benzoate, aspirin, sodium salicylate and cinnamic acid.

Unusual equipment: Electric, steam and gas ovens and furnaces of nearly all sizes up to 2 x 3 x 3 feet, capable of any temperature range up to 1500 degrees C.; temperature measuring equipment ranging from -100 degrees C. to +1750 degrees C.; laboratory kneading and mixing machine; grinding machinery; 2 autoclaves; apparatus for cement testing; Tyler sieve-shaking machine; Saybolt and Redwood viscosimeters; apparatus for coal testing; gas analysis and photographic apparatus; gas meters and photometer bench; motor-driven pump for gas compression up to 200 pounds per square inch, and hand apparatus up to 10,000 pounds per square inch.

250. Souther, Henry, Engineering Co., The, 11 Laurel St., Hartford, Conn. Consulting Engineers.

Research staff: F. P. Gilligan, 13 technically trained assistants and 8 others.

Research work: Small part time of 22 on oils, waters and greases, ferrous and non-ferrous metals, methods of heat-treatment, electroplating, foundry practice, boiler water treatment.

Unusual equipment: Pyrometers, furnaces, lead pot, for experimental heat treatment; 100,000-pound Olsen physical testing machine,

Izod impact tester, White-Souther endurance machines, microphotographic outfit, and lathe, drill-press and other ordinary equipment. In Newlands Sanitary Laboratory, microscopes, refractometer, oil testing equipment, incubators and other chemical and bacteriological apparatus.

251. Southern Cotton Oil Company, The, 120 Broadway, New York, N. Y.

Research staff: David Wesson and 1 or 2 assistants.

Research work: Full time of staff on improving methods of analyses on cotton seed products and investigation of catalyzers and their preparation, hydrogenizing fats.

252. Spencer Lens Company, Buffalo, N. Y. Research laboratory at Hamburg, N. Y., in optical glass factory.

Research staff: Harry G. Ott and 2 technically trained assistants.

Research work: Large part time of 3 on problems connected with manufacture of various types of optical glass.

253. Sperry, D. R., & Co., Batavia, Ill. Founders and engineers; makers of filter presses and evaporators. Sperry Filtration Laboratory.

Research staff: D. R. Sperry.

Research work: One-fourth time of 1 on systematic effort to determine fundamental laws of filtration.

Unusual equipment: Special filter presses.

254. Sprague, Warner & Company, 600 West Erie St., Chicago, Ill. Manufacturers and wholesalers of groceries.

Research staff: Paul D. Potter and 2 trained chemists.

Research work: One-third time of 3 on problems relating to food.

255. Spreckels Sugar Company, 60 California St., San Francisco, Cal.

Research staff: R. N. Kennedy, 1 chief chemist, 3 assistant chemists and 6 bench chemists through operating season of three months; 1 chief chemist and 1 assistant chemist in off season of nine months.

Research work: Equivalent of time of 1 man for nine months on extraction and purification of juices; minimization of sugar losses; reduction of fuel-oil, lime and filter-cloth consumption; recovery of potash soda and ammonia compounds from Steffen waste.

256. Squibb, E. R., & Sons, New Brunswick, N. J. Research and Biological Laboratories.

Research staff: John F. Anderson, 6 bacteriologists and 3 chemists.

Research work: One-fourth time of 10 on biological and biochemical problems.

Unusual equipment: For the production for commercial purposes, of products for theoretical research in the various phases of biological therapeutics.

257. Standard Oil Company, 26 Broadway, New York, N. Y. Central laboratory at Linden, N. J. Other laboratories at principal plants of the Standard Oil Company in the United States and abroad.

Research staff: Frank A. Howard and others.

Research work: Petroleum refining, petroleum products and natural gas.

258. Stevens, M. T., & Sons Co., North Andover, Mass.

Research staff: John F. Bannan, 1 chemist and 2 dyers.

Research work: One-tenth time of 4 on dyeing problems.

259. Stewart-Warner Speedometer Corporation, Chicago, Ill. Manufactures speedometers, spark-plugs, vacuum gasoline systems and other automobile accessories.

Research staff: J. E. Genn, 1 inventor and advisory engineer, 1 factory manager and 1 assistant chief engineer.

Research work: Part time of 4 on investigations of fuel feed systems, tachometers and other automobile equipment.

Unusual equipment: For testing tachometer indications at varying temperatures, from 12 to 150 degrees F.; Sprague electric, cradle-type dynamometer, capacity 50 to 75 H. P. 4000 maximum revolutions per minute; Shore scleroscope; Brinell hardness meter; complete equipment for tests and experiments on vacuum feed systems.

260. Stone & Webster, 147 Milk St., Boston, Mass. Engineers, constructors, bankers, operators of public utilities.

Research staff: 2 chemists, 2 mechanics, 1 laborer.

Research work: Full time of 5 on needs of industrial companies, mostly now on zinc.

Unusual equipment: Largely special to research on electrolytic zinc refining.

261. Strathmore Paper Company, Mittineague, Mass.

Research staff: Justus C. Sanburn and 1 assistant.

Research work: One-fifth time of 2 on special paper mill problems; sizing paper with rosin.

262. Structural Materials Research Laboratory, Lewis Institute, 1951 West Madison St., Chicago, Ill.

Research staff: D. A. Abrams, 5 engineers or physicists, 1 chemist, 7 assistants, 2 stenographers, 2 machinists and 5 laborers.

Research work: Full time of 23 on a variety of problems in cement and concrete.

Unusual equipment: One 200,000-pound and one 40,000-pound screw power Universal testing machine, one 20,000-pound torsion testing machine, one 4-unit Deval abrasion machine for tests of road materials, 1 Standard ball mill for tests of road materials, 1 Ro-Tap sieve shaker for fineness tests of materials, 1 Talbot-Jones rattler for wear tests of concrete, 1 autoclave apparatus for high-pressure steam tests of cement, 1 laboratory crusher, 2 concrete mixing machines; complete equipment for physical tests of cement, aggregates, mortars and concrete.

263. Studebaker Corporation, The, Detroit, Mich. Manufactures automobiles and other vehicles.

Research staff: C. Breer; 2 engineers and 1 mechanic in the dynamometer department; 1 electrical engineer and 1 assistant in the electrical department; 1 chemist in the chemical department; 1 engineer, 1 assistant and a staff of mechanics in the road testing department; 1 engineer on special work.

Research work: One-half to two-thirds time of staff on power output of motors, investigations of electrical appurtenances for automobiles, chemical studies of materials used in manufacture, road testing of automobiles, special problems related to radiators, brakes, oil pumps, fans and other equipment of an automobile.

Unusual equipment: Production laboratory has complete me-

chanical, metallurgical and physical testing apparatus, including tensile, torsional and compression machines. Research laboratory: 3 complete electric dynamometer equipments for motors up to 80-horsepower output; completely equipped for investigations of ignition apparatus, lighting and starting apparatus, storage batteries and all other electrical appurtenances of automobiles; apparatus for qualitative analysis of all materials used in manufacture and special equipment for investigating oils and grease; apparatus for unusual problems concerning radiators, brake-linings, oil-pumps, fans and belts.

264. Titanium Alloy Manufacturing Company, The, Niagara Falls, N. Y.

Research staff: L. E. Barton, 3 in chemical laboratory, 2 in metallographic and physical testing laboratory, 2 in research and development work in outside steel plants.

Research work: Full time of 8 on problems related to manufacture and use of ferro-carbon-titanium, development of titanox pigments, development of titanium-aluminum bronze.

265. Toch Brothers, 320 Fifth Ave., New York, N. Y. Makers of paints, varnishes, colors, enamels; acid, alkali and damp-proof coatings.

Research staff: Maximilian Toch and 4 to 6 chemists.

Research work: One-half time of 1 on problems related to waterproofing and protection of Portland cement by integral and surface coating methods; waterproofing of structural materials.

266. Tolhurst Machine Works, Troy, N. Y. Specialists in centrifugals (hydro-extractors).

Research staff: T. A. Bryson, usually 1 engineer and 1 or 2 assistants.

Research work: One-sixth time of 3 on determination of profitable methods of separation (and washing) of liquids from liquids or solids by means of centrifugal force; apparatus for dewatering sewage sludge; separation of foots from oil, recovery of glycerine and salt in soap industry, and improved methods of treating fish and fish oil.

Unusual equipment: Centrifugal machines for filtration, extraction and sedimentation, ranging from small hand-driven, tube and basket centrifuges to higher speed 12 gallons basket capacity centrifugals, with interchangeable baskets of various types for crystalline, granular or fibrous materials, slimes and sludges.

267. Underwriters' Laboratories, 207 East Ohio St., Chicago, Ill. Established and maintained by National Board of Fire Underwriters. Departments: Protection, Electrical, Gases and Oils, Chemical, Casualty.

Research staff: W. H. Merrill and 60 experts and necessary assistants.

Research work: An indefinite but large proportion of time of staff on studies of fire-prevention and fire-fighting appliances; welded joints in non-fired pressure containers; rating liquids as to inflammability and explosion hazard; rate of propagation of flame and explosion of various mixtures of gases from volatile liquids with air in piping; explosive ranges of mixtures of hydrogen and oxygen, and of oxygen and hydrogen, at pressures around 2000 pounds per square inch; temperatures of flame of oxy-acetylene welding and cutting burners.

Unusual equipment: Chemical and physical equipment and some electrical apparatus, including that for analysis and physical testing of rubber and gases.

268. Union Switch & Signal Company, Swissvale, Pa. Manufactures railway signal equipment. Materials laboratories are maintained separately under the direction of H. C. Loudenbeck, with 12 chemists and C. P. Miller, physicist, with 13 trained men.

Research staff: C. O. Harrington, Jr., and 7 assistants.

Research work: One-third time of 8 on development of iron for electro-magnets, including survey of existing sources and experiments with new alloys; development of best methods of annealing and testing this iron, and determination of standards of acceptance and rejection; selection of materials for, and design of certain special types of, electrical contacts; investigation of proposed methods of testing moulded insulations, including sampling and test of most insulations and porcelains available in this country; development of processes and selection of materials for impregnation of electro-magnet coils and of lumber.

Unusual equipment: Photographic outfit; oscillographs; galvanometers of different sensitivity; numerous pyrometers of varying sensitivities; standardization equipment for electrical instruments; potentiometer; electric muffle furnaces; electric ovens; porcelain tube high-temperature furnace; 50,000-volt insulation testing transformer; hydraulic Brinell machine; Ericksen sheet metal tester; scleroscope; Heissler impact testing machine; 3 Olsen machines having capacities, respectively, 200, 2,000 and 50,000 pounds; an experimental impregnating plant, oil heated, with vacuum and pressure pump.

269. United Alloy Steel Corporation, Canton, Ohio. Open hearth and electric steels, bars, slabs, billets, blooms, universal plates.

Research staff: M. H. Schmid, 1 metallurgical engineer, 1 assistant metallurgical engineer, 1 laboratory foreman, 10 assistants and 1 engineer of tests; in the Electric Furnace, 1 chief and 2 recorders; in the Open Hearth Furnace, 1 chief and 8 recorders; in the Rolling Mills, 1 chief and 4 recorders.

Research work: One-half time of 32 on investigations connected with production and use of steel.

Unusual equipment: Heat treatment: 4 Hoskins' electric furnaces, 1 American gas furnace for pieces up to 20 inches length and 5 inches diameter. Physical testing: equipped for tensile, torsion, cold bend, vibratory, Izod, Brinell, scleroscope, staybolt, etc.; also Leeds & Northrup permeameter for determining magnetic permeability of steel and one Leeds & Northrup recalescence instrument for determining critical points of steel. Micro-photography: complete metallographic, photomicrographic and dark-room apparatus.

270. United Drug Co., Boston, Mass.

Research staff: Edward C. Merrill and 15 chemists.

Research work: One-half time of 16, largely on pharmaceutical investigations and research, and independent problems covering miscellaneous subjects.

271. United Gas Improvement Co., The, 3101 Passyunk Ave., Philadelphia, Pa.

Research staff: Chas. O. Bond, 3 physicists, 2 engineers, 1 chemist, 4 assistants, office force and mechanic.

Research work: One-half time of staff on color photometry and studies leading to improvement of gas lighting; wider utilizing of gas;

improvement or increase of by-products; studies in the efficiency of light production; results upon various gases of subjecting them to various physical agencies.

Unusual equipment: Light standards, radial, bar and spherical photometers; electrical measurements; pyrometers and heat measuring instruments; calorimeters; gas and electric furnaces; compressors, holders and storage tanks for gas samples; gas analysis apparatus; specific gravity apparatus; life testing racks for gas lamps; vaporizing and condensing apparatus for gas experiments; instrument maker and equipped shop; photograph and microphoto work; Gaede vacuum pump; glass working bench; storage batteries; gas meters and governors and pumps in variety.

272. United Shoe Machinery Corporation, Boston, Mass. Laboratory at Beverly.

Research staff: Walter Gould Bullard and assistants.

Research work: Examination of raw materials; extensive tests on core oils and compounds, systematic investigation on improvement in antiseptic quality of cutting compounds and on pickling steel bars and plates.

273. U. S. Conditioning and Testing Co., 316 Hudson St., New York, N. Y.

Research staff: W. F. Edwards, 5 chemists, 3 engineers and 1 physico-chemist.

Research work: One-half time of 10 on investigations of problems arising in textile and allied industries.

Unusual equipment: For investigation of effect of light on dyed textiles.

274. U. S. Food Products Corp., Peoria, Ill.

Research staff: J. K. Dale and 2 chemists; R. Stutyke and 1 engineer.

Research work: Full time of 5 on food development problems.

275. United States Glue Co., Milwaukee, Wis.

Research staff: C. R. McKee and 3 trained men.

Research work: One-half time of 4 on improvements in technology in glue and gelatine industry, particularly development of processes to produce glue and gelatine for various specific purposes, such as gelatine with various photographic properties, food gelatine, marshmallow gelatine and special glue.

Unusual equipment: Complete miniature glue and gelatine factory, dark room for photographic testing and equipment for chemical and biological work.

276. U. S. Industrial Alcohol Co., 27 William St., New York, N. Y. Laboratory at South Baltimore, Md.

Research staff: A. A. Backhaus and 20 or 25 chemists and chemical engineers.

Research work: Full time of staff on research in connection with utilization of alcohol in manufacture of many chemical products, and utilization of by-products of alcohol manufacture.

Unusual equipment: Adequate semi-commercial scale equipment for testing processes developed in chemical laboratory.

277. United States Metals Refining Co., Chrome, N. J.

Research staff: H. D. Greenwood, in charge of chemical department, W. C. Smith, in charge of metallurgical department; about 42 assistants.

Research work: Part time of staff on maintaining a high standard in plant metallurgy and discovering new and improved methods.

Unusual equipment: Chemical, metallurgical and assay equipment. Apparatus for electrolytic determinations. Hoopes conductivity bridge with special balance for weighing wire. Special apparatus for annealing wire. Complete metallographic outfit.

United States Steel Corporation. See Carnegie Steel Company.

278. Upjohn Company, The, Kalamazoo, Mich. Makers of fine pharmaceuticals.

Research staff: Frederick W. Heyl, 4 or 5 chemists, 1 pharmacologist, 1 bacteriologist.

Research work: Part time of .7 on estimation of nitroglycerine; analyses of two Echinacea roots; standardization of commercial papain; some constituents of the roots of *Brauneria augustifolia*; some constituents of *Sunbul* root; standardization of the mercurials; *Algenta* root; some constituents of *jambul*; analysis of ragweed pollen; chemical examination of the leaves of *Adonis vernalis*; protein extract of ragweed pollen.

279. Vacuum Oil Company, Rochester, N. Y. Laboratories also at Olean, N. Y., and Paulsboro, N. J.

Research staff: Florus R. Baxter, 2 chemists at Rochester, 1 chemist at Olean and 1 chemist at Paulsboro.

Research work: One-fifth time of 5 on detection of minute impurities in lubricating oils and perfecting methods for their removal; causes of deterioration of oils in service; elimination and utilization of by-products.

Unusual equipment: Fire, steam and vacuum stills, lead lined agitators fully equipped, wax presses, electric ovens, super-centrifuges, etc.

280. Victor Chemical Works, Fisher Building, Chicago, Ill. Large laboratory for factory control and general work and two smaller ones for research.

Research staff: Robert A. Holbrook, 7 chemists and 2 engineers.

Research work: Full time of 8 and one-half time of 2 on problems connected with manufacturing activities.

281. Wahl-Henius Institute, Incorporated, 1135 Fullerton Ave., Chicago, Ill.

Research staff: Max Henius, 4 experts, 1 chief analytical chemist, 1 chief research chemist, 3 assistant chemists and 3 assistants.

Research work: Full time of chief research chemist and about one-half time of 1 assistant chemist on fermentation and packing-house problems.

Unusual equipment: Apparatus for testing products of fermentation industries and for carrying out experimental work on semi-commercial scale (experimental brewery, bottlery, etc.). Apparatus for testing solid and liquid fuel, and lubricants; differential refractometer (Tornoe's).

282. Waltham Watch Company, Waltham, Mass.

Research staff: F. P. Flagg and 3 chemists.

Research work: Full time of 2 on investigation of the properties of enamel used on watch dials and study of the properties of metals and their relation to watch production.

283. Warner, William R., & Company, Incorporated, 113 West 18th St., New York, N. Y. Manufacturing pharmacutists.

Research staff: L. F. Warren and 2 chemists.

Research work: Full time of 1 and one-half time of 1 on critical study of quantities of alcohol used for extractive and preservative purposes in a number of pharmaceutical preparations.

Unusual equipment: Apparatus for distillation under reduced pressure and for the continuous extraction of drugs under reduced pressure.

Warren, S. D., & Co. See Cumberland Mills.

284. Washburn-Crosby Co., Minneapolis, Minn. Flour mills.

Research staff: Frank W. Emmons, 3 chemists, 1 specially trained physical laboratory man, 1 expert baker and various assistants.

Research work: Full time of 1 on problems relating to wheat flour.

Unusual equipment: All apparatus needed for making analysis on flour and wheat.

285. Welsbach Company, Gloucester, N. J. Manufactures mantles for illuminating gas.

Research staff: Harlan S. Miner and 6 trained men.

Research work: One-half time of 7 directed especially to economic production of rare earth chemicals, especially thorium and cerium; manufacture of special rare earth salts, nitration of cellulose, production of mesothorium; radio-chemistry.

Unusual equipment: Especially for the study of problems connected with development of incandescent gas mantles.

286. Western Aniline Products Company, 36 South State St., Chicago, Ill. Manufacturers of chemicals and intermediates for dye industry.

Research staff: 1 chemical engineer, 2 chemists.

Research work: Full time of 1 chemist, part time of chemical engineer on the lighter hydrocarbons; special application toluol products.

Unusual equipment: Nitrator, reducer, sulphonater, fractionating still. Electric furnaces, heaters, etc.

287. Western Electric Company, Incorporated, 463 West St., New York, N. Y. Laboratories of Western Electric Company are functionally a part of the engineering activities of the whole Bell Telephone System.

Research staff: Frank B. Jewett; H. D. Arnold, Physical Laboratory, with about 10 experts, about 40 college trained men and about 60 laboratory assistants; J. W. Harris, Chemical Laboratory, with 3 or 4 experts and about 20 chemists and laboratory assistants; R. L. Jones, Transmission Laboratory, with several experts, about 30 college trained men, and about 50 laboratory assistants; G. A. Anderegg, Physical Testing Laboratory, with about 40 college trained men and 60 other assistants; about 600 engineers, designers, draftsmen and assistants. Total, about 925.

Research work: Major part time of research staff. In Chemical Laboratory, metallurgical problems include both magnetic and non-

magnetic materials; inorganic products, preservation of timber, very thin and high-grade papers used in telephone condensers. In Physical Research Laboratory problems vary from nature of microphonic action in a telephone transmitter to high vacua phenomena in vacuum tube repeaters and amplifiers; solution of distribution of electric currents in the unsteady state, in circuit networks of a complicated nature; fundamental characteristics of speech transmission.

Unusual equipment: Physical Research Laboratory is equipped for fundamental research in all problems relating to telephony, telegraphy and signaling, including land lines, radio and submarine cable, and practically any line of electrical research which does not involve use of electrical energy in exceedingly large amounts; and physical properties and behavior of materials under conditions of interest to communication engineers.

Chemical Research Laboratory is equipped for organic and inorganic chemistry and has facilities for metallurgical research.

Transmission Research Laboratory, transmission apparatus, particularly transmitters, receivers and associated apparatus.

Physical Testing Laboratory does not carry on fundamental research; has apparatus for physical and engineering tests particularly on communication apparatus and material involved in manufacture of such apparatus.

288. Western Precipitation Company, 1016 West Ninth St., Los Angeles, Cal.

Research staff: H. V. Welch, 1 physicist, 1 engineer, 4 chemists.

Research work: Three-fourths to nine-tenths time of 7 on problems entering around the Cottrell Processes of electrical precipitation.

Unusual equipment: Chemical laboratory, general analytical equipment. Physical laboratory, equipped particularly with high potential electrical apparatus, including 150,000-volt transformer, 50,000-volt direct current generator, high potential mechanical rectifiers, other rectification equipment, measuring instruments, etc., heating equipment and blowers, also small electric furnace. Potash laboratory, digestion and filtration apparatus, including small Oliver filter and special apparatus adapted for study of equilibrium conditions in solutions.

289. Western Sugar Refinery, Foot 23rd St., San Francisco, Cal.

Research staff: S. C. Meredith, 1 chief chemist, 3 engineers, 3 assistant chemists, and 12 workers on routine work.

Research work: Two-fifths time of 8 on investigations of sugar losses, sugar machinery and materials.

290. Westinghouse Church Kerr & Co., Incorporated, 37 Wall St., New York, N. Y.

Research staff: Cloyd M. Chapman and 3 assistants.

Research work: One-half time of 4 cooperating with Am. Soc. Testing Materials on cement, concrete, timber, corrosion of iron and steel, preservative coatings. Load-bearing value of soils for foundations. Analyses of paints, putty and similar materials.

Unusual equipment: Cement and concrete testing apparatus, complete including 200,000-pound hydraulic compression machine, 100,000-pound motor-driven Olsen tension and compression machine.

291. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Research staff: C. E. Skinner, 1 engineer of research division, 1 manager of engineering, 15 chemists, 15 physicists and 100 mechanics and other assistants.

Research work: Full time of 45 and one-half time of 88 on lamp investigations, incandescent solids, luminous gases, magnetic materials; photomicrographic, electrolytic, metallurgical and photometric investigations; conductivity of metals; linear temperature coefficients; electrical insulation.

Unusual equipment: Five completely equipped laboratories. Routine Chemical, Process, Molded Materials, Electrical, and the Research Building. Also the Standard House.

292. Westinghouse Lamp Co., East Pittsburgh, Pa. Engineering and Development Laboratories at Bloomfield, N. J., under the direction of R. E. Myers with a staff of 87. Research Laboratory at East Pittsburgh.

Research staff: H. C. Rentschler, 2 physicists, 2 assistant physicists and 1 chemist.

Research work: Full time of 6 on study of radiation from solids and gases and vapors; also high vacua phenomena.

Unusual equipment: Apparatus for obtaining and measuring high vacua, for producing high potential rectified current and for photometric and optical pyrometer measurements. High frequency electric furnace. Liquid air available at all times. Rare gases for study of their properties and uses are available.

293. Weston, Byron, Co., Dalton, Mass. Manufactures ledger and record paper.

Research staff: P. W. Codurse and 1 assistant.

Research work: Varying amount time of 2 on problems connected with paper making.

294. Weston & Sampson, 14 Beacon St., Boston, Mass. Specialize in water sanitation.

Research staff: R. S. Weston and 1 assistant.

Research work: Small part time of 2 on food problems.

Unusual equipment: Apparatus and facilities for mechanical analysis of filter sands.

295. Wilson & Co., Chicago, Ill. Packers and provisioners. Laboratories at Chattanooga, Tenn., Oklahoma City, Okla., and Kansas City, Mo.

Research staff: L. M. Tolman and 10 assistants.

Research work: One-half time of 11 on problems connected with fermentation, spoilage, etc.; hydrogenation of oils, refining and handling of oils and by-products.

296. Winchester Repeating Arms Co., New Haven, Conn.

Research staff: J. S. Gravely, 8 research chemists, 5 metallurgists and metallographists, 4 electrochemists and engineers, and 32 assistants and routine workers.

Research work: Three-fifths time of 50 on materials and processes involved in the manufacture of small arms and ammunition, cutlery, tools, hardware and sporting goods, dry batteries, flashlights, etc.

297. Zinsser & Co., Hastings-on-Hudson, N. Y.

Research staff: W. A. Lipstate, 6 chemists and 2 chemical engineers.

Research work: Full time of 9 on problems of organic chemistry, intermediates, dyes, medicants, etc.

Unusual equipment: Industrial laboratory completely equipped for semi-factory units.

Geographical Classification of Laboratories Connected with Industrial Establishments

CALIFORNIA**Benicia**

Kullman, Salz & Co.

Berkeley

Heinrich Laboratories of Applied Chemistry

Los Angeles

Western Precipitation Company

Martinez

Martinez Refinery, Shell Co. of California

Oxnard

American Beet Sugar Company

Redlands

Redlands Fruit Products Company

San Francisco

Beckman and Linden Engineering Corporation

Bethlehem Shipbuilding Corporation, Ltd.

Spreckels Sugar Company

Western Sugar Refinery

COLORADO**Denver**

Great Western Sugar Company, The

CONNECTICUT**Bridgeport**

Bridgeport Brass Company

Columbia Graphophone Manufacturing Company

Crane Co.

Remington Arms, United Metallic Cartridge Company

Hartford

Souther, Henry, Engineering Co., The

Meriden

International Silver Company

New Haven

Kolynos Co., The

Winchester Repeating Arms Co.

Waterbury

American Brass Company, The

Chase Metal Works

Scovill Manufacturing Company

DELAWARE**Newport**

Krebs Pigment and Chemical Co., The

Wilmington

Atlas Powder Co.

du Pont, E. I., de Nemours, & Co.

D. C., WASHINGTON

Institute of Industrial Research, The
National Canners Association

FLORIDA**Jacksonville**

Florida Wood Products Co.

Pensacola

Newport Turpentine & Rosin Company of Florida

GEORGIA**Atlanta**

American Research Fund

Lockhart Laboratories

Maynard, T. Poole

ILLINOIS**Batavia**

Sperry, D. R., & Co.

Chicago

Armour Glue Works

Belden Manufacturing Company

Brach, E. J., and Sons

Burdett Manufacturing Company

By-Products Coke Corporation

Central Scientific Company

Commonwealth Edison Company

Crane Co.

Dearborn Chemical Company

Industrial Research Laboratories
 Lindsay Light Company
 Mojonnier Bros. Co.
 Morris & Company
 Page, Carl M.
 Redmanol Chemical Products Co.
 Schoenhofen, Peter, Brewing Company, The
 Sears, Roebuck and Co.
 Sprague, Warner & Company
 Stewart-Warner Speedometer Corporation
 Structural Materials Research Laboratory, Lewis Institute
 Underwriters' Laboratories
 Victor Chemical Works
 Wahl-Henius Institute, Inc.
 Western Aniline Products Company
 Wilson & Co.
 La Salle
 Carus Chemical Company
 Peoria
 U. S. Food Products Corp.
 Springfield
 Sangamo Electric Company

INDIANA

Indiana Harbor
 Inland Steel Company
 Indianapolis
 Lilly, Eli, and Company
 Prest-O-Lite Co. Inc., The
 Kokomo
 Kokomo Steel and Wire Co.

MAINE

Bangor
 Eastern Manufacturing Company
 Cumberland Mills
 Cumberland Mills
 Portland
 Lincoln, E. S., Inc.

MARYLAND

Baltimore
 Bloede, Victor G., Co.
 Davison Chemical Company
 Musher and Company, Inc.

MASSACHUSETTS

Boston
 American Agricultural Chemical Company, The

Associated Factory Mutual Fire Insurance Companies
 Boston Bio-Chemical Laboratory, (Inc.), The
 Cabot, Samuel, Inc.
 Kalmus, Comstock & Westcott, Inc.
 New England Confectionery Company
 Stone & Webster
 United Drug Co.
 United Shoe Machinery Corporation
 Warren, S. D., & Co.
 Weston & Sampson
 Cambridge
 Little, Arthur D., Inc.
 Chicopee Falls
 Fisk Rubber Company, The
 Dalton
 Crane & Co.
 Weston, Byron, Co.
 Fall River
 Scott, Ernest & Company
 Holyoke
 American Writing Paper Co.
 Lawrence
 Arlington Mills
 Medford
 American Radio and Research Corporation
 Mittineague
 Strathmore Paper Company
 North Andover
 Stevens, M. T., & Sons Co.
 North Woburn
 Merrimac Chemical Co.
 Norwood
 Morrill, Geo. H., Co.
 Southbridge
 American Optical Company
 Springfield
 Emerson Laboratory
 Waltham
 Waltham Watch Company
 Watertown
 Hood Rubber Company
 Worcester
 Norton Company

MICHIGAN

Bay City
 Industrial Works

MICHIGAN (*Continued*)

Detroit

Berry Bros., Inc.
Detroit Edison Company, The
Detroit Testing Laboratory, The
Digestive Ferments Company
General Motors Corporation
Hoskins Manufacturing Company
Packard Motor Car Company
Parke, Davis & Company
Studebaker Corporation, The

Flint

Champion Ignition Co.

Kalamazoo

Upjohn Company, The

Muskegon

Brunswick - Balke - Collender Co.,
The

MINNESOTA

Minneapolis

Howard Wheat and Flour Testing
Laboratory, The
Minneapolis Steel and Machinery
Co.
Washburn-Crosby Co.

MISSOURI

St. Louis

American Zinc, Lead and Smelting
Company
Laclede-Christy Clay Products Com-
pany
Monsanto Chemical Works
Nowak Chemical Laboratories

MONTANA

Anaconda

Anaconda Copper Mining Co.

NEBRASKA

Omaha

Cudahy Packing Company, The

NEW HAMPSHIRE

Berlin

Brown Company (formerly Berlin
Mills Company)

Manchester

Amoskeag Manufacturing Company

NEW JERSEY

Bayonne

Babcock & Wilcox Co., The

International Nickel Co., The
Bloomfield

Condensite Company of America

Boonton

Boonton Rubber Manufacturing
Company

Bound Brook

Peerless Color Company

Camden

MacAndrews & Forbes Company

Chrome

United States Metals Refining Co.

Edgewater

Corn Products Refining Company

Elizabeth

Duesenberg Motors Corporation

Garfield

Hamersley M'f'g Co., The

Gloucester

Welsbach Company

Hoboken

Keuffel & Esser Co.

Jersey City

Davis-Bournonville Company
Eagle Printing Ink Co., The

Kenil

Hercules Powder Company

Montclair

Ellis, Carleton, Laboratories

Newark

Butterworth-Judson Corporation
Dehls & Stein, Inc.
Gray Industrial Laboratories, The
Rubber Trade Laboratory

New Brunswick

Squibb, E. R. & Sons

Orange

Edison, Thomas A., Laboratory

Passaic

Manhattan Rubber Mfg. Co., The
Pantasote Leather Company, The
Perth Amboy

General Bakelite Company

Raritan Copper Works

Roessler & Hasslacher Chemical
Company, The

Phillipsburg

Baker, J. T., Chemical Co.

NEW YORK

Auburn

Case Research Laboratory

Binghamton

AnSCO Company

Brooklyn

Chandler Engineering Corporation

Doehler Die-Casting Co.

National Lead Company

Buffalo

Beaver Company, The

Buffalo Foundry and Machine Co.

Dominion Natural Gas Co., Ltd.

Larkin Co.

Linde Air Products Company

Lumen Bearing Company

National Aniline & Chemical Company, Inc.

Spencer Lens Company

Corning

Corning Glass Works

Garden City

Curtiss Engineering Corporation, The

Hastings-on-Hudson

Zinsser & Co.

Lackawanna

Babcock Testing Laboratory

New York

Abbé Engineering Company

Aetna Explosives Company, Inc.

American Can Company

American Cotton Oil and Associated Cos.

American Cyanamid Company

American Leather Research Laboratory

American Sugar Refining Company, The

Arbuckle Brothers

Barrett Company, The

DeLaval Separator Co., The

Dorr Company, The

Eimer & Amend

Electrical Testing Laboratories

General Chemical Co.

Guggenheim Bros.

Hochstadter Laboratories

Holz & Company, Inc.

Industrial Testing Laboratories

Kidde, Walter, & Company, Inc.

Kraus Research Laboratories, Inc.

Lederle Laboratories

Marvin-Davis Laboratories, Inc.

Merck & Co.

Metal & Thermit Corporation

Metz, H. A., Laboratories, Inc.

National Biscuit Company

National Gum & Mica Co.

Nestlé's Food Company, Inc.

New Jersey Zinc Company, The

Permutit Co., The

Phelps Dodge Corporation

Schwarz Laboratories

Southern Cotton Oil Company, The

Standard Oil Company

Toch Brothers

U. S. Conditioning and Testing Co.

U. S. Industrial Alcohol Co.

Warner, William R., & Company

Western Electric Company

Westinghouse Church Kerr & Co., Incorporated

Niagara Falls

Acheson Graphite Company

Carborundum Company, The

Electro-Metallurgical Company

FitzGerald Laboratories, Inc., The

Hooker Electrochemical Co.

Mathieson Alkali Works (Inc.), The

Niagara Alkali Co.

Titanium Alloy Manufacturing Company, The

Oswego

Diamond Match Co., The

Poughkeepsie

Reliance Aniline & Chemical Co.

Rochester

Art in Buttons

Bausch & Lomb Optical Co.

Eastman Kodak Company

Pfaudler Co., The

Vacuum Oil Company

Schenectady

General Electric Company

Syracuse

Merrell-Soule Laboratory

Semet-Solvay Company

Solvay Process Company, The

Troy

Gurley, W. & L. E.

Tolhurst Machine Works

Watervliet

Ludlum Steel Company

NORTH CAROLINA**Charlotte**

Charlotte Chemical Laboratories, Inc.

NORTH CAROLINA (*Continued*)

Morgantown

Kistler, Lesh & Company

OHIO

Akron

Firestone Tire & Rubber Company
General Tire & Rubber Co.

Goodrich, B. F., Company, The

Goodyear Tire & Rubber Company,
The

Miller Rubber Co., The

Barberton

Portage Rubber Co., The

Canton

United Alloy Steel Corporation

Cincinnati

Ault & Wiborg Company, The

Drackett, P. W., & Sons Co., The

Lunkenheimer Co., The

Cleveland

Aluminum Castings Co., The

Cleveland Testing Laboratory Co.,
The

Glidden Company, The

Martin, Glenn L., Company, The

National Carbon Company, Inc.

National Lamp Works of General
Electric Co., Nela Research Labora-
tory

Cuyahoga Falls

Falls Rubber Company, The

Dayton

Dayton Engineering Laboratories Co.

Electro Chemical Company, The

Marietta

Northwestern Chemical Co., The

Middletown

American Rolling Mill Co., The

St. Bernard

Globe Soap Co.

Toledo

Buckeye Clay Pot Co.

Industrial Research Corporation

Wooster

Medina Gas & Fuel Co.

OKLAHOMA

Bartlesville

Empire Gasoline Company

Empire Gas & Fuel Company

Tulsa

Cosden & Company

PENNSYLVANIA

Altoona

Pennsylvania Railroad Company, The
Arnold

American Window Glass Co.

Bridgeville

American Vanadium Company

Glenolden

Mulford, H. K., Company

Mechanicsburg

Scientific Instrument and Electrical
Machine Company, The

Philadelphia

Atlantic Refining Company, The

Baldwin Locomotive Works, The

Cramp, William, & Sons Ship &
Engine Building Co., The

Dill & Collins Co.

Harrison Safety Boiler Works

Leeds & Northrup Company, The

Midvale Steel Company, The

Pennsylvania Salt Manufacturing Co.

Philadelphia Quartz Company

Powers - Weightman - Rosengarten
Company, The

United Gas Improvement Co., The

Pittsburgh

American Sheet and Tin Plate Co.

Byers, A. M., Company

Carnegie Steel Company

Harbison-Walker Refractories Com-
pany

Koppers, H., Company

Mellon Institute of Industrial Re-
search and School of Specific In-
dustries

National Tube Company

Pittsburgh Testing Laboratory

Westinghouse Electric & Manufac-
turing Company

Westinghouse Lamp Co.

Rochester

Beaver Valley Glass Company and

Fry, H. C., Glass Company

Swissvale

Union Switch & Signal Company

RHODE ISLAND

Providence

Brown & Sharpe Mfg. Co.

Providence Gas Company

Rumford Chemical Works

TENNESSEE

Knoxville
Nichols Laboratories, The

TEXAS

Houston
Gulf Pipe Line Company

VIRGINIA

Norfolk
Royster, F. S., Guano Company

WASHINGTON

Seattle
Kilbourne & Clark Manufacturing
Company
Littlefield Laboratories Co.

Tacoma

Bennetts' Chemical Laboratory

WEST VIRGINIA

Charleston
Klipstein, E. C., & Sons Co.

WISCONSIN

Milwaukee
Corona Chemical Company
Cutler-Hammer Mfg. Co., The
Gallun, A. F., & Sons Co.
Milwaukee Coke & Gas Company, The
Patton Paint Company
Pfister & Vogel Leather Co.
Pitcairn Varnish Company
United States Glue Co.

**Scientific and Engineering Classification for Laboratories Connected
with Industrial Establishments (According to the Kind
of Work Done or Connected Industry)**

This classification is intended to apply to research laboratories merely for convenience in allocating work or filing information. It has therefore been kept simple. Headings have been taken from *Chemical Abstracts* and *Science Abstracts*, from the names of the laboratories, and from suggestions by members of the Engineering Foundation, the National Research Council and others engaged in research work. Additions can be made as found necessary. Cross-references listed are merely suggestions; they can be increased or cancelled to meet convenience. For the purpose in hand, distinction is made between classifying *laboratories* and classifying scientific and industrial *knowledge*. It is believed that this simple scheme will suffice for the former. Headings are arranged alphabetically; those from *Chemical Abstracts* are designated by *, and those from *Science Abstracts* by @. Some laboratories belong in more than one class. Some of the classes provided have not yet been found necessary.

This classification has been adopted by the Research Committee of the American Society of Mechanical Engineers. It is used in *Mechanical Engineering*, the monthly journal of that Society for reporting in brief the progress and problems of research recorded in current literature.

No.	Class	Cross-references
1.	Abrasives	Carborundum, Emery, Grinding, Polishing, Sandpaper
2.	*Acids, Alkalies, Salts & Sundries	Chemicals (heavy and fine)
3.	Agricultural Equipment & Engineering	Land Drainage, Threshing Machines, Tractors

No.	Class	Cross-references
4.	Air	Air-driven Machines, Air Products, Compressed Air, Liquid Air
5.	Aircraft	Aeronautics, Airplanes, Balloons, Dirigibles (See also Internal Com- bustion Motors)
6.	*Apparatus & Instruments (Chemical, Physical)	Autoclaves, Balances, Compasses, Gages, Lenses, Microscopes, Tel- escopes, Transits.
7.	@Astronomy	
8.	Automotive Vehicles & Equipment	Automobiles, Tanks, Tractors, Trucks
9.	Beverages, non-alcoholic	
10.	*Cellulose & Paper	Pulp
11.	*Cement & other Building Materials	Concrete, Marble, Slate
12.	Centrifugals	
13.	*Chemistry, Analytical	
14.	*Chemistry, Biological	Bacteriology, Biology
15.	*Chemistry, General & Physical	
16.	*Chemistry, Inorganic	Carbon, Graphite
17.	*Chemistry, Mineralogical & Geological	Quartz
18.	*Chemistry, Organic	Fermentation, Starch, Vegetable Oils
19.	*Chemistry, Pharmaceutical	Dentifrice, Drugs, Medicine
20.	Computing, Recording & Talking Devices	Adding Machines, Cash Registers, Phonographs, Talking Machines
21.	Concentration of Ores	Flotation
22.	*Dyes & Textile Chemistry	Anilines, Inks, Intermediates, Pig- ments
23.	Economics	
24.	Electrical Communication	Cable, Telegraph, Telephone, Wire- less
25.	Electricity, General	Economics, Insulation, Utilization
26.	Electrical Instruments	Ammeters, Voltmeters, Wattmeters
27.	Electro-plating	
28.	*Electric Power	Conversion, Distribution, Genera- tion, Motors, Plants (power), Transmission
29.	*Electrochemistry	Electro-chemical processes, Storage batteries
30.	*Explosives and Explosions	Dynamite, Powder, TNT
31.	*Fats, Fatty Oils & Soaps	

No.	Class	Cross-references
32.	Fire Prevention	Extinguishers, Sprinklers
33.	*Foods	Bakery, Baking Powder, Biscuit, Butter, Canning, Cold Storage, Flavoring Extracts, Flour, Milk, Oils, Preservatives, Wheat, Yeast
34.	Foundry Equipment, Materials & Methods	Casting, Die Casting, Moulding
35.	*Fuels, Gas, Tar & Coke	Alcohol, Charcoal, Coal, Gasoline, Kerosene, Oil, Peat, Petroleum, Wood
36.	Fuel Utilization	Boilers, Furnaces, Gas-Producers, Stokers
37.	Gases, General	Pneumatics, Poisonous Gas (See also Fuels, and Illumination)
38.	*Glass & Ceramics	Bricks, China, Pottery, Porcelain, Refractories
39.	@ Heat	Calorimetry, Pyrometry, Thermal physics, Thermometry.
40.	Heating	
41.	Hydraulics	Waterworks, Water power
42.	Illumination (Electric, Gas & other)	
43.	Insulation (Electrical and Thermal)	Non-conductors
44.	Internal Combustion Motors	Diesel engine, Gasoline engine, Oil engine
45.	Iron & Steel	Ferrous alloys
46.	*Leather & Glue	Shoes, Boots
47.	@Light	Optical Instruments, Optics (See also Illumination)
48.	*Liquors, Fermented & Distilled	Beer, Wine
49.	Lubricants	Graphite, Oil, Petroleum
50.	Machine Tools	Drill-press, Lathe, Planer, Shaper
51.	@Magnetism	
52.	Marine Engineering	Ships
53.	Mathematics	
54.	Mechanics, General	Bearings (Ball, Roller, etc.)
55.	Metal Manufactures, mis- cellaneous	Pipes and Fittings
56.	Metallurgy & Metallography	
57.	@Meteorology	
58.	Metrology	Weights and measures

No.	Class	Cross-references
59.	Military & Naval Equipment	Ammunition, Armor, Ordnance, Small Arms, Torpedoes
60.	Mining, General (Testing drills, ropes, tools: Ore dressing)	
61.	Molecular Physics	
62.	Non-ferrous Metals	Aluminum, Brass, Bronze, Copper, Gold, Platinum, Silver, Tin
63.	*Paints, Varnishes & Resins	Dryers, Enamels, Lacquers, Oil, Pigments, Putty
64.	*Petroleum, Asphalt & Wood Products	Linoleum, Oilcloth
65.	*Photography	Cameras, Developers, Films, Mov- ing-picture equipment
66.	@Properties of Engineering Materials	
67.	Pulverizing	Crushing, Grinding
68.	Railroad Rolling-stock & Accessories	Cars, Locomotives
69.	Railroad Tracks & Signals	
70.	Refrigeration	Artificial Ice
71.	Road Materials & Equipment	Highways
72.	*Rubber & Allied Substances	Gutta-percha and substitutes, rubber manufactures
73.	Safety Devices (Transportation, Manufactures, Mines)	
74.	*Soils & Fertilizers	Nitrates, Phosphates
75.	@Sound	Acoustics
76.	Steam Power	Boilers, Economizers, Engines, Tur- bines
77.	*Subatomic Phenomena & Radio-activity	
78.	*Sugar	Sorghums, Syrups
79.	Surgical, Dental & Hospital Equipment	
80.	Textile Manufacture & Clothing	Cotton, Linen, Wool
81.	Transmission	See also Electric Power
82.	Ventilation	
83.	*Water, Sewage & Sanitation	
84.	Welding (Autogenous, gas, electric, forge)	
85.	Wood Products (other than Cellulose & Paper)	See also Cellulose and Paper

Cross-references

Subject	See No.	Subject	See No.
Acoustics.....	75	Coal.....	35
Adding machines.....	20	Coke.....	35
Aeronautics.....	5	Cold storage.....	33
Air-driven machines.....	4	Compasses.....	6
Airplanes.....	5	Compressed air.....	4
Air products.....	4	Concrete.....	11
Alcohol.....	35	Conversion.....	28
Alkalies.....	2	Copper.....	62
Aluminum.....	62	Cotton.....	80
Ammeters.....	26	Crushing.....	67
Ammunition.....	59	Dental equipment.....	79
Analytical chemistry.....	13	Dentifrice.....	19
Anilines.....	22	Developers.....	65
Armor.....	59	Die casting.....	34
Artificial ice.....	70	Diesel engine.....	44
Asphalt products.....	64	Dirigibles.....	5, 44
Autoclaves.....	6	Distribution.....	28
Automobiles.....	8	Drill press.....	50
Bacteriology.....	14	Drugs.....	19
Bakery.....	33	Dryers.....	63
Baking powder.....	33	Dynamite.....	30
Balances.....	6	Economics.....	25
Balloons.....	5	Economizers.....	76
Bearings (ball, roller, etc.).....	54	Emery.....	1
Beer.....	48	Electro-chemical processes.....	29
Biological chemistry.....	14	Engines.....	76
Biology.....	14	Extinguishers.....	32
Biscuit.....	33	Enamels.....	63
Boilers.....	36, 76	Fermentation.....	18
Boots.....	46	Ferrous alloys.....	45
Brass.....	62	Fertilizers.....	74
Bricks.....	38	Films.....	65
Bronze.....	62	Flavoring extracts.....	33
Building materials.....	11	Flotation.....	21
Butter.....	33	Flour.....	33
Cable.....	24	Furnaces.....	36
Calorimetry.....	39	Gages.....	6
Cameras.....	65	Gas.....	35
Canning.....	33	Gasoline.....	35
Carbon.....	16	Gasoline engine.....	44
Carborundum.....	1	Gas producers.....	36
Cars.....	68	General and physical chem- istry.....	15
Cash registers.....	20	Generation.....	28
Casting.....	34	Glue.....	46
Ceramics.....	38	Gold.....	62
Charcoal.....	35	Graphite.....	16, 49
Chemicals (heavy & fine).....	2	Grinding.....	1, 67
Chemistry, physical.....	15	Gutta-percha & substitutes ..	72
China.....	38		

Cross-references (*Continued*)

Subject	See No.	Subject	See No.
Highways.....	71	Platinum.....	62
Hospital equipment.....	79	Pneumatics.....	37
Inks.....	22	Poisonous gas.....	35, 37, 42
Inorganic chemistry.....	16	Polishing.....	1
Instruments.....	6	Porcelain.....	38
Insulation.....	25	Pottery.....	38
Intermediates.....	22	Powder.....	30
Internal combustion motors...	5	Preservatives.....	33
Kerosene.....	35	Pyrometry.....	39
Lacquers.....	63	Pulp.....	10
Land drainage.....	3	Putty.....	63
Lathe.....	50	Quartz.....	17
Lenses.....	6	Radioactivity.....	77
Linen.....	80	Recording devices.....	20
Linoleum.....	64	Refractories.....	38
Liquid air.....	4	Resins.....	63
Locomotives.....	68	Rolling stock.....	68
Marble.....	11	Rubber manufactures.....	72
Medicine.....	19	Salts.....	2
Metallography.....	56	Sandpaper.....	1
Microscopes.....	6	Sanitation.....	83
Milk.....	33	Sewage.....	83
Mineralogical & geological chemistry.....	17	Shaper.....	50
Motors.....	28	Ships.....	52
Moulding.....	34	Shoes.....	46
Moving picture equipment.....	65	Signals.....	69
Naval equipment.....	59	Silver.....	62
Non-conductors.....	43	Slate.....	11
Nitrates.....	74	Small arms.....	59
Oil.....	35, 49, 63	Soaps.....	31
Oils.....	33	Sorghums.....	78
Oilcloth.....	64	Sprinklers.....	32
Oil engine.....	44	Starch.....	18
Optical instruments.....	42, 47	Stokers.....	36
Optics.....	42, 47	Storage batteries.....	29
Ordnance.....	59	Syrups.....	78
Ores.....	21	Talking devices.....	20
Organic chemistry.....	18	Talking machines.....	20
Paper.....	10	Tanks.....	8
Peat.....	35	Tar.....	35
Petroleum.....	35, 49	Telegraph.....	24
Pharmaceutical chemistry.....	19	Telephone.....	24
Phonographs.....	20	Telescopes.....	6
Phosphates.....	74	Textile chemistry.....	22
Pigments.....	22, 63	Thermal physics.....	39
Pipes & fittings.....	55	Thermometry.....	39
Planer.....	50	Threshing machines.....	3
Plants (power).....	28	Tin.....	62
		TNT.....	30

Subject	See No.	Subject	See No.
Torpedoes.....	59	Water power.....	41
Tractors.....	3, 8	Waterworks.....	41
Transits.....	6	Wattmeters.....	26
Transmission.....	28	Weights and measures.....	58
Transportation.....	73	Wheat.....	33
Trucks.....	8	Wine.....	48
Turbines.....	76	Wireless.....	24
Utilization.....	25	Wood.....	35
Varnishes.....	63	Wood products.....	64
Vegetable oils.....	18	Wool.....	80
Voltmeters.....	26	Yeast.....	33

Scientific and Engineering Classification of Laboratories Connected with Industrial Establishments

ABRASIVES

Carborundum Company, The
Norton Company
Nowak Chemical Laboratories
Scovill Manufacturing Company

FitzGerald Laboratories, Inc., The
Fry, H. C., Glass Company
Gurley, W. & L. E.
Industrial Research Corporation
Keuffel & Esser Co.
Leeds & Northrup Company, The
Lunkenheimer Co., The
Minneapolis Steel and Machinery Co.
Sangamo Electric Company
Scientific Instrument and Electrical
Machine Company, The
Studebaker Corporation, The
Tolhurst Machine Works
Waltham Watch Company

ACIDS, ALKALIES, SALTS AND SUN- DRIES

du Pont, E. I., de Nemours & Company
Hooker Electrochemical Co.
Mathieson Alkali Works (Inc.), The
Merrimac Chemical Co.
Niagara Alkali Co.
Pennsylvania Salt Manufacturing Co.
Powers-Weightman-Rosengarten
Company, The
Solvay Process Company, The

AUTOMOTIVE VEHICLES AND EQUIPMENT

Northwestern Chemical Co., The
Packard Motor Car Company

AIR

Linde Air Products Company
Packard Motor Car Company

BAKELITE AND CONDENSITE

Condensite Company of America
General Bakelite Company

AIRCRAFT

Curtiss Engineering Corporation, The
Martin, Glenn L., Company, The
Packard Motor Car Company

CELLULOSE AND PAPER

American Writing Paper Co.
Beaver Company, The
Brown Company (formerly Berlin Mills
Company)
Crane & Co.
Cumberland Mills
Dill & Collins Co.
du Pont, E. I., de Nemours & Company
Eastern Manufacturing Company
Emerson Laboratory

APPARATUS AND INSTRUMENTS

Baldwin Locomotive Works, The
Bethlehem Shipbuilding Corporation,
Ltd.
Brown & Sharpe Mfg. Co.
Central Scientific Company
Cutler-Hammer Mfg. Co., The
Eimer & Amend

Hammersley M'f'g Co.
Little, Arthur D., Inc.
Maynard, T. Poole
Strathmore Paper Company
Weston, Byron, Co.

CEMENT AND OTHER BUILDING MATERIALS

Buckeye Clay Pot Co.
Industrial Research Laboratories
Institute of Industrial Research, The
Structural Materials Research Laboratory, Lewis Institute
Toch Brothers
Westinghouse Church Kerr & Co., Inc.

CENTRIFUGALS

De Laval Separator Co., The
Tolhurst Machine Works

CHEMISTRY, ANALYTICAL

American Optical Company
Armour Glue Works
Bridgeport Brass Company
Carborundum Company, The
Drackett, P. W., & Sons Co., The
General Bakelite Company
General Motors Corporation
Industrial Testing Laboratories
Kidde, Walter, & Company, Incorporated
Little, Arthur D., Inc.
Marvin-Davis Laboratories, Incorporated
Merck & Co.
Nichols Laboratories, The
Pantasote Leather Company, The
Scovill Manufacturing Company

CHEMISTRY, BIOLOGICAL

Bennetts' Chemical Laboratory
Boston Bio-Chemical Laboratory (Inc.), The
Dehls & Stein, Inc.
Digestive Ferments Company
Kolynos Co., The
Lederle Laboratories
Merrell Soule Laboratory
Morris & Company
Mulford, H. K., Company
National Canners Association
Parke, Davis & Company

Schoenhofen, Peter, Brewing Company, The
Sprague, Warner & Company
Squibb, E. R., & Sons
United States Glue Co.
Upjohn Company, The
Weston & Sampson
Wilson & Co.

CHEMISTRY, GENERAL AND PHYSICAL

Art in Buttons, Incorporated
Edison, Thomas A., Laboratory
Kalmus, Comstock & Westcott, Inc.
Little, Arthur D., Inc.
Littlefield Laboratories Co.
Mellon Institute of Industrial Research
Victor Chemical Works
Western Precipitation Company

CHEMISTRY, INORGANIC

Acheson Graphite Company
American Writing Paper Co.
Babcock & Wilcox Co., The
Baker, J. T., Chemical Co.
Burdett Manufacturing Company
Carus Chemical Company
Chandler Engineering Corporation
Cumberland Mills
Davison Chemical Company
Dearborn Chemical Company
Detroit Testing Laboratory, The
Drackett, P. W., & Sons Co., The
FitzGerald Laboratories, Inc., The
General Chemical Co.
Industrial Research Laboratories
Lindsay Light Company
Little, Arthur D., Inc.
Merrimac Chemical Co.
National Gum & Mica Co.
Permutit Company, The
Pittsburgh Testing Laboratory
Squibb, E. R., & Sons

CHEMISTRY, MINERALOGICAL AND GEOLOGICAL

Philadelphia Quartz Company

CHEMISTRY, ORGANIC

American Cotton Oil and Associated Cos.
American Research Fund
Arlington Mills

Baker, J. T., Chemical Co.
 Beckman and Linden Engineering Corporation
 Bennetts' Chemical Laboratory
 Bloede, Victor G., Co.
 Burdett Manufacturing Company
 Carus Chemical Company
 Chandler Engineering Corporation
 du Pont, E. I., de Nemours & Company
 Ellis, Carleton, Laboratories
 General Chemical Co.
 Industrial Research Laboratories
 Lindsay Light Company
 Little, Arthur D., Inc.
 Musher and Company, Incorporated
 National Gum & Mica Co.
 Pittsburgh Testing Laboratory
 Southern Cotton Oil Company, The
 Spreckels Sugar Company
 Squibb, E. R., & Sons
 Western Sugar Refinery
 Zinsser & Co.

CHEMISTRY, PHARMACEUTICAL

American Research Fund
 Cudahy Packing Company, The
 Eimer & Amend
 Heinrich Laboratories of Applied Chemistry
 Kolynos Co., The
 Larkin Co.
 Lilly, Eli, and Company
 Merck & Co.
 Metz, H. A., Laboratories, Inc.
 Monsanto Chemical Works
 Mulford, H. K., Company
 Parke, Davis & Company
 Pittsburgh Testing Laboratory
 Squibb, E. R., & Sons
 United Drug Co.
 Upjohn Company, The
 Warner, William R., & Company, Incorporated
 Zinsser & Co.

COMPUTING, RECORDING AND TALKING DEVICES

Columbia Graphophone Manufacturing Company
 Edison, Thomas A., Laboratory

DYES & TEXTILE CHEMISTRY

Amoskeag Manufacturing Company

Arlington Mills
 Ault & Wiborg Company, The
 Butterworth-Judson Corporation
 Dehls & Stein, Inc.
 du Pont, E. I., de Nemours & Company
 Eagle Printing Ink Co., The
 Klipstein, E. C., & Sons Co.
 MacAndrews & Forbes Company
 Metz, H. A., Laboratories, Inc.
 Morrill, Geo. H., Co.
 National Aniline & Chemical Company, Inc.
 Peerless Color Company
 Reliance Aniline & Chemical Co., Incorporated
 Roessler & Hasslacher Chemical Company, The
 Sears, Roebuck and Co.
 Semet-Solvay Company
 Stevens, M. T., & Sons Co.
 U. S. Conditioning and Testing Co.
 Western Aniline Products Company
 Zinsser & Co.

ELECTRICAL COMMUNICATION

American Radio and Research Corporation
 Kilbourne & Clark Manufacturing Company
 Western Electric Company, Incorporated
 Westinghouse Electric & Manufacturing Company

ELECTRICITY, GENERAL

Belden Manufacturing Company
 Cutler-Hammer Mfg. Co., The
 Edison, Thomas A., Laboratory
 General Electric Company
 Page, Carl M.
 Western Electric Company, Incorporated
 Westinghouse Electric & Manufacturing Company

ELECTRICAL INSTRUMENTS

Cutler-Hammer Mfg. Co., The
 Hoskins Manufacturing Company
 Leeds & Northrup Company, The
 Scientific Instrument and Electrical Machine Company, The

ELECTRIC POWER

Champion Ignition Co.
Commonwealth Edison Company
Dayton Engineering Laboratories Co.
Detroit Edison Company, The
General Electric Company
Lincoln, E. S., Inc.
National Carbon Company, Inc.

ELECTROCHEMISTRY

Beckman and Linden Engineering Corporation
Charlotte Chemical Laboratories, Inc.
Electro Chemical Company, The
Electro-Metallurgical Company
FitzGerald Laboratories, Inc., The
Guggenheim Bros.
Hooker Electrochemical Co.
International Silver Company
Kalmus, Comstock & Westcott, Inc.
Littlefield Laboratories Co.
National Carbon Company, Inc.

EXPLOSIVES AND EXPLOSIONS

Aetna Explosives Company, Inc.
Atlas Powder Co.
Barrett Company, The
du Pont, E. I., de Nemours & Company
Hercules Powder Company

FATS, FATTY OILS AND SOAPS

American Cotton Oil and Associated Cos.
Arlington Mills
Globe Soap Co.
Larkin Co.
Little, Arthur D., Inc.
Lockhart Laboratories
Mojonnier Bros. Co.

FIRE PREVENTION

Associated Factory Mutual Fire Insurance Companies
MacAndrews & Forbes Company
Underwriters' Laboratories

FOODS

American Can Company
American Cotton Oil and Associated Cos.
Babcock Testing Laboratory
Brach, E. J., and Sons
Cleveland Testing Laboratory Co., The

Corn Products Refining Company
Cudahy Packing Company, The
Detroit Testing Laboratory, The
Hochstadter Laboratories
Howard Wheat and Flour Testing Laboratory, The
Industrial Research Laboratories
Lederle Laboratories
Marvin-Davis Laboratories, Incorporated
Merrell-Soule Laboratory
Mojonnier Bros. Co.
Morris & Company
Musher and Company, Incorporated
National Canners Association
Nestlé's Food Company, Incorporated
New England Confectionery Company
Pittsburgh Testing Laboratory
Redlands Fruit Products Company
Rumford Chemical Works
Schoenhofen, Peter, Brewing Company, The
Schwarz Laboratories
Sears, Roebuck and Co.
Sprague, Warner & Company
U. S. Food Products Corp.
Wahl-Henius Institute, Incorporated
Washburn-Crosby Co.
Weston & Sampson
Wilson & Co.

**FOUNDRY EQUIPMENT,
MATERIALS AND METHODS**

Aluminum Castings Co., The
American Brass Company, The
Buffalo Foundry and Machine Co.
Crane Co.
Doehler Die-Casting Co.

FUELS, GAS, TAR AND COKE

Arlington Mills
Atlantic Refining Company, The
Barrett Company, The
Cosden & Company
Dearborn Chemical Company
Empire Companies, The
Gray Industrial Laboratories, The
Gulf Pipe Line Company
Industrial Research Laboratories
Koppers, H., Company
Lockhart Laboratories

Martinez Refinery, Shell Co. of California
 Medina Gas & Fuel Co.
 Milwaukee Coke & Gas Company, The
 Nichols Laboratories, The
 Providence Gas Company
 Schoenhofen, Peter, Brewing Company, The
 Spreckels Sugar Company
 Standard Oil Company
 United Gas Improvement Co., The
 Vacuum Oil Company

FUEL UTILIZATION

Babcock & Wilcox Co., The
 Harrison Safety Boiler Works

GASES, GENERAL

Burdett Manufacturing Company
 Linde Air Products Company

GLASS AND CERAMICS

American Window Glass Co.
 Babcock Testing Laboratory
 Bausch & Lomb Optical Co.
 Beaver Valley Glass Company
 Buckeye Clay Pot Co.
 Carborundum Company, The
 Champion Ignition Co.
 Corning Glass Works
 Electro-Metallurgical Company
 Fry, H. C., Glass Company
 Harbison-Walker Refractories Company
 Hoskins Manufacturing Company
 Keuffel & Esser Co.
 Kraus Research Laboratories, Inc.
 Laclede-Christy Clay Products Company
 Maynard, T. Poole
 Norton Company
 Nowak Chemical Laboratories
 Pfaudler Co., The
 Pittsburgh Testing Laboratory
 Spencer Lens Company
 Waltham Watch Company

HEAT

Bethlehem Shipbuilding Corporation, Ltd.
 Commonwealth Edison Company
 General Motors Corporation
 Leeds & Northrup Company, The
 Wahl-Henius Institute, Incorporated

HYDRAULICS

Associated Factory Mutual Fire Insurance Companies
 Harrison Safety Boiler Works

ILLUMINATION (Electric, Gas & Other)

Burdett Manufacturing Company
 Electrical Testing Laboratories
 National Carbon Company, Inc.
 National Lamp Works of General Electric Co.
 Page, Carl M.
 Prest-O-Lite Co., Inc., The
 Providence Gas Company
 United Gas Improvement Co., The
 Welsbach Company
 Westinghouse Lamp Co.

INTERNAL COMBUSTION MOTORS

Duesenberg Motors Corporation
 General Motors Corporation
 Studebaker Corporation, The

IRON AND STEEL

American Rolling Mill Co., The
 American Sheet and Tin Plate Co.
 American Vanadium Company
 Byers, A. M., Company
 Carnegie Steel Company
 Cleveland Testing Laboratory Co., The
 Crane Co.
 Holz & Company, Inc.
 Inland Steel Company
 Kokomo Steel and Wire Co.
 Ludlum Steel Company
 Metal & Thermit Corporation
 Midvale Steel Company, The
 Minneapolis Steel and Machinery Co.
 National Tube Company
 Pfaudler Co., The
 United Alloy Steel Corporation

LEATHER AND GLUE

American Leather Research Laboratory
 Armour Glue Works
 Brunswick-Balke-Collender Co., The
 Cudahy Packing Company, The
 Gallun, A. F., & Sons Co.
 Kistler, Lesh & Company
 Kullman, Salz & Co.
 Morris & Company

Nichols Laboratories, The
Pantasote Leather Company, The
Pfister & Vogel Leather Co.
United States Glue Co.

LIGHT

American Optical Company
Ansco Company
Bausch & Lomb Optical Co.
Case Research Laboratory
Corning Glass Works
Eastman Kodak Company
Fry, H. C., Glass Company
Keuffel & Esser Co.
National Lamp Works of General Electric Co.
Spencer Lens Company

LIQUORS, FERMENTED AND DISTILLED

Schoenhofen, Peter, Brewing Company, The
Scott, Ernest, & Company
U. S. Industrial Alcohol Co.
Wahl-Henius Institute, Incorporated
Warner, William R., & Company, Incorporated

LUBRICANTS

Acheson Graphite Company
Gray Industrial Laboratories, The
Lockhart Laboratories
Martinez Refinery, Shell Co. of California
Pittsburgh Testing Laboratory
Standard Oil Company
Vacuum Oil Company

MACHINE TOOLS

Brown & Sharpe M'fg Co.
Chandler Engineering Corporation
Industrial Research Corporation
United Shoe Machinery Corporation

MARINE ENGINEERING

Bethlehem Shipbuilding Corporation, Ltd.
Cramp, William, & Sons Ship & Engine Building Co., The

MECHANICS, GENERAL

Chandler Engineering Corporation
Lumen Bearing Company

METAL MANUFACTURES, MISCELLANEOUS

American Vanadium Company
Crane Co.

METALLURGY AND METALLOGRAPHY

Aluminum Castings Co., The
American Brass Company, The
American Optical Company
American Rolling Mill Co., The
American Sheet and Tin Plate Co.
American Vanadium Company
Anaconda Copper Mining Co.
Bennett's Chemical Laboratory
Bridgeport Brass Company
Buffalo Foundry and Machine Co.
Byers, A. M., Company
Carnegie Steel Company
Cleveland Testing Laboratory Co., The
Crane Co.
Dorr Company, The
Electro-Metallurgical Company
General Electric Company
Guggenheim Bros.
Holz & Company, Inc.
International Nickel Co., The
Kalmus, Comstock & Westcott, Inc.
Kokomo Steel and Wire Co.
Lunkenheimer Co., The
Maynard, T. Poole
Metal & Thermit Corporation
Midvale Steel Company, The
Page, Carl M.
Raritan Copper Works
Scovill Manufacturing Company
Souther, Henry, Engineering Co., The
Stewart-Warner Speedometer Corporation
Stone & Webster
Titanium Alloy Manufacturing Company, The
United Alloy Steel Corporation
United States Metals Refining Co.

MILITARY AND NAVAL EQUIPMENT

Remington Arms, United Metallic Cartridge Company
Winchester Repeating Arms Co.

NON-FERROUS METALS (Aluminum)

Aluminum Castings Co., The

NON-FERROUS METALS (Copper)

Anaconda Copper Mining Co.
Phelps Dodge Corporation
Raritan Copper Works

NON-FERROUS METALS

American Brass Company, The
American Sheet and Tin Plate Co.
American Vanadium Company
American Zinc, Lead and Smelting Company
Bridgeport Brass Company
Chase Metal Works
Crane Co.
Cramp, William & Sons Ship & Engine Building Co., The
Gurley, W. & L. E.
Hoskins Manufacturing Company
International Nickel Co., The
International Silver Company
Metal & Thermit Corporation
National Lead Company
New Jersey Zinc Company, The
Scovill Manufacturing Company
Titanium Alloy Manufacturing Company, The
United States Metals Refining Co.

PAINTS, VARNISHES AND RESINS

Babcock Testing Laboratory
Berry Bros., Inc.
Cabot, Samuel, Inc.
du Pont, E. I., de Nemours & Company
Glidden Company, The
Industrial Research Laboratories
Krebs Pigment and Chemical Co., The
National Lead Company
Newport Turpentine & Rosin Company of Florida
Patton Paint Company
Redmanol Chemical Products Co.
Sears, Roebuck and Co.
Toch Brothers
Westinghouse Church Kerr & Co., Incorporated

PETROLEUM, ASPHALT AND WOOD PRODUCTS

Atlantic Refining Company, The
Empire Companies, The
Florida Wood Products Co.
Gulf Pipe Line Company

Institute of Industrial Research, The
Krebs Pigment and Chemical Co., The
Lockhart Laboratories
Martinez Refinery, Shell Co. of California
Medina Gas & Fuel Co.
Standard Oil Company
Vacuum Oil Company

PHOTOGRAPHY

AnSCO Company
Eastman Kodak Company
Kalmus, Comstock & Westcott, Inc.

PROPERTIES OF ENGINEERING MATERIALS

Carnegie Steel Company
Chandler Engineering Corporation
Duesenberg Motors Corporation
General Electric Company
Institute of Industrial Research, The
Kokomo Steel and Wire Co.
Mellon Institute of Industrial Research
Pennsylvania Railroad Company, The
Scovill Manufacturing Company
Stewart-Warner Speedometer Corporation
Stone & Webster
Structural Materials Research Laboratory, Lewis Institute
United Shoe Machinery Corporation

PULVERIZING

Abbé Engineering Company
Philadelphia Quartz Company

RAILROAD ROLLING-STOCK AND ACCESSORIES

Baldwin Locomotive Works, The
Industrial Works
Pennsylvania Railroad Company, The

RAILROAD TRACK AND SIGNALS

Pennsylvania Railroad Company, The
Union Switch & Signal Company

RUBBER AND ALLIED SUBSTANCES

Belden Manufacturing Company
Boonton Rubber Manufacturing Company
Brunswick-Balke-Collender Co., The
Falls Rubber Company, The
Firestone Tire & Rubber Company
Fisk Rubber Company, The

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| <p>General Bakelite Company
 General Tire & Rubber Co.
 Goodrich, B. F., Company, The
 Goodyear Tire & Rubber Company,
 The
 Hood Rubber Company
 Krebs Pigment and Chemical Co., The
 Manhattan Rubber Mfg. Co., The
 Miller Rubber Co., The
 Portage Rubber Co., The
 Rubber Trade Laboratory</p> <p>SOILS AND FERTILIZERS</p> <p>American Agricultural Chemical Com-
 pany, The
 American Cyanamid Company
 Cudahy Packing Company, The
 Morris & Company
 Royster, F. S., Guano Company</p> <p>STEAM POWER</p> <p>Babcock & Wilcox Co., The
 Harrison Safety Boiler Works</p> <p>SUGAR</p> <p>American Beet Sugar Company
 American Sugar Refining Company,
 The</p> | <p>Arbuckle Brothers
 Digestive Ferments Company
 Great Western Sugar Company, The
 Spreckels Sugar Company
 Western Sugar Refinery</p> <p>TEXTILE MANUFACTURE AND CLOTHING</p> <p>Amoskeag Manufacturing Company
 Arlington Mills
 Bloede, Victor G., Co.
 Emerson Laboratory
 Sears, Roebuck and Co.
 U. S. Conditioning and Testing Co.</p> <p>WATER, SEWAGE AND SANITATION</p> <p>Dearborn Chemical Company
 Dorr Company, The
 Harrison Safety Boiler Works
 Lederle Laboratories
 Permutit Company, The
 Souther, Henry, Engineering Co., The
 Weston & Sampson</p> <p>WELDING</p> <p>Davis-Bourmonville Company
 Metal & Thermit Corporation</p> |
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Commercial Classification of Laboratories Connected with Industrial Establishments

NOTE.—In this list the laboratories are grouped under selected trade designations in common use. The number of classes has been kept small and provides only for the laboratories, concerning which information has been obtained. It can, however, readily be extended.

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| <p>1. ABRASIVES AND GRINDING</p> <p>Armour Sand Paper Works
 Carborundum Company, The
 Norton Company</p> <p>2. ADHESIVES (Glue, Paste, Gum, Sizing, etc.)</p> <p>Armour Glue Works
 Bloede, Victor G., Co.
 Brunswick-Balke-Collender Co.,
 The
 National Gum & Mica Co.
 United States Glue Co.</p> <p>3. AIRCRAFT (Airplanes, Balloons, Dirigibles; Accessories)</p> | <p>Chandler Engineering Corporation
 Curtiss Engineering Corporation,
 The
 Martin, Glenn L., Company, The</p> <p>4. APPARATUS AND INSTRUMENTS (Astronomical, Chemical, Physical, Surveying, etc.)</p> <p>Bausch & Lomb Optical Co.
 Buffalo Foundry and Machine Co.
 Central Scientific Company
 Chandler Engineering Corporation
 Eimer & Amend
 Gurley, W. & L. E.
 Holz & Company, Inc.
 Keuffel & Esser Co.</p> |
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- Scientific Instrument and Electrical Machine Company, The
Waltham Watch Company
5. AUTOMOBILES AND ACCESSORIES
Duesenberg Motors Corporation
Firestone Tire & Rubber Company
General Motors Corporation
Northwestern Chemical Co., The
Packard Motor Car Company
Prest-O-Lite Co., Inc., The
Stewart-Warner Speedometer Corporation
Studebaker Corporation, The
 6. BEVERAGES (Beers, Wines, Liquors, and Non-Alcoholic Drinks)
Dehls & Stein, Inc.
Nowak Chemical Laboratories
Schoenhofen, Peter, Brewing Company, The
Wahl-Henius Institute, Incorporated
 7. BIOLOGICAL EQUIPMENT AND SUPPLIES
Digestive Ferments Company
Lilly, Eli, and Company
Mulford, H. K., Company
 8. BOOTS AND SHOES (Including Machinery)
United Shoe Machinery Corporation
 9. BRASS, BRONZE, BEARING METALS, COPPER
American Brass Company, The
Anaconda Copper Mining Co.
Bridgeport Brass Company
Chase Metal Works
Cramp, William, & Sons Ship & Engine Building Co., The
Lumen Bearing Company
Phelps Dodge Corporation
Raritan Copper Works
Remington Arms, United Metallic Cartridge Company
Scovill Manufacturing Company
United States Metals Refining Co.
Waltham Watch Company
Western Precipitation Company
 10. BUILDING MATERIALS; CEMENT
Beaver Company, The
Pennsylvania Railroad Company, The
Structural Materials Research Laboratory, Lewis Institute
Westinghouse Church Kerr & Co., Incorporated
 11. BY-PRODUCTS FROM WASTES
Babcock Testing Laboratories
Guggenheim Bros.
Scott, Ernest, & Company
Semet-Solvay Company
Vacuum Oil Company
Western Precipitation Company
Wilson & Co.
 12. CANS AND OTHER METAL CONTAINERS
American Can Company
National Cannery Association
 13. CERAMICS (Bricks, Pottery, Refractories)
Buckeye Clay Pot Co.
Carborundum Company, The
Champion Ignition Co.
Corning Glass Works
Electro-Metallurgical Company
Harbison-Walker Refractories Company
Kraus Research Laboratories, Inc.
Laclede-Christy Clay Products Company
Pfaudler Co., The
Powers-Weightman-Rosengarten Company, The
 14. CHEMICALS, FINE
Baker, J. T., Chemical Co.
Carus Chemical Company
Digestive Ferments Company
General Chemical Co.
Lindsay Light Company
Merck & Co.
Monsanto Chemical Works
Pennsylvania Salt Manufacturing Co.
Squibb, E. R., & Sons
 15. CHEMICALS, HEAVY (Bulk, Acids, Salts, etc.)
Armour Ammonia Works

- Davison Chemical Company
 Drackett, P. W., & Sons Co., The
 Du Pont, E. I., de Nemours & Company
 General Chemical Co.
 Hooker Electrochemical Co.
 Kidde, Walter, & Company, Incorporated
 Mathieson Alkali Works (Inc.), The
 Merrimac Chemical Co.
 Niagara Alkali Co.
 Pennsylvania Salt Manufacturing Co.
 Philadelphia Quartz Company
 Powers - Weightman - Rosengarten Company, The
 Roessler & Hasslacher Chemical Company, The
 Semet-Solvay Company
 Solvay Process Company, The
 U. S. Industrial Alcohol Co.
 Victor Chemical Works
16. COTTON AND ITS PRODUCTS
 American Cotton Oil and Associated Cos.
 Southern Cotton Oil Company, The
17. DIVERSIFIED MANUFACTURING
 Brunswick-Balke-Collender Co., The
 Larkin Co.
 Sears, Roebuck and Co.
18. DRYERS, EVAPORATORS, SEPARATORS, CONCENTRATORS, FILTER PRESSES, GRINDING AND PULVERIZING MACHINERY
 Abbé Engineering Company
 Buffalo Foundry and Machine Co.
 DeLaval Separator Co., The
 Dorr Company, The
 Sperry, D. R., & Co.
 Tolhurst Machine Works
 Western Precipitation Company
19. DYESTUFFS
 Bloede, Victor G., Co.
 Butterworth-Judson Corporation
- Dehls & Stein, Inc.
 Klipstein, E. C., & Sons Co.
 Lindsay Light Company
 MacAndrews & Forbes Company
 Metz, H. A., Laboratories, Inc.
 National Aniline & Chemical Company, Inc.
 Peerless Color Company
 Reliance Aniline & Chemical Co., Incorporated
 U. S. Conditioning and Testing Co.
 Western Aniline Products Company
 Zinsser & Co.
20. ELECTRICAL EQUIPMENT
 (Dynamoes, Motors, Lamps, Instruments, Telephones, Batteries; Light and Power Plants)
 Commonwealth Edison Company
 Cutler-Hammer Mfg. Co., The
 Dayton Engineering Laboratories Co.
 Detroit Edison Company, The
 Edison, Thomas A., Laboratory
 Electrical Testing Laboratories
 Electro Chemical Company, The
 General Electric Company
 Hoskins Manufacturing Company
 Kilbourne & Clark Manufacturing Company
 Leeds & Northrup Company, The
 Lincoln, E. S., Inc.
 National Carbon Company, Inc.
 National Lamp Works of General Electric Co.
 Sangamo Electric Company
 Western Electric Company, Incorporated
 Westinghouse Electric & Manufacturing Company
 Westinghouse Lamp Co.
 Winchester Repeating Arms Co.
21. ENGINES AND MOTORS (other than electric)
 Duesenberg Motors Corporation
 General Motors Corporation
22. EXPLOSIVES
 Aetna Explosives Company, Inc.
 Atlas Powder Co.

- du Pont, E. I., de Nemours & Company
Hercules Powder Company
Remington Arms, United Metallic Cartridge Company
Winchester Repeating Arms Co.
23. FERTILIZERS
American Agricultural Chemical Company, The
American Cyanamid Company
Royster, F. S., Guano Company
24. FIRE PREVENTION
Associated Factory Mutual Fire Insurance Companies
MacAndrews & Forbes Company
Underwriters' Laboratories
25. FOODSTUFFS (Including Candy, Baking Powder, Flavoring Extracts)
Arbuckle Bros.
Brach, E. J., and Sons
Corn Products Refining Company
Cudahy Packing Company, The
Howard Wheat and Flour Testing Laboratory, The
Marvin-Davis Laboratories, Incorporated
Merrell-Soule Laboratory
Mojonnier Bros. Co.
Morris & Company
Musher and Company, Incorporated
National Cannery Association
Nestlé's Food Company, Incorporated
New England Confectionery Company
Nowak Chemical Laboratories
Redlands Fruit Products Company
Rumford Chemical Works
Sprague, Warner & Company
U. S. Food Products Corp.
Wahl-Henius Institute, Incorporated
Washburn-Crosby Co.
Wilson & Co.
26. FUELS (Coal, Charcoal, Coke, Gas, Oil, Peat, Wood, etc.)
Empire Companies, The
Koppers H., Company
- Milwaukee Coke & Gas Company, The
27. GAS (Fuel and Illuminating) INCLUDING MANTLES
Linde Air Products Company
Medina Gas & Fuel Co.
Prest-O-Lite Co., Inc., The
Providence Gas Company
Standard Oil Company
United Gas Improvement Co., The
Welsbach Company
28. GASES (except fuel and illuminating), INCLUDING GENERATING APPARATUS
Burdett Manufacturing Company
Florida Wood Products Co.
Hooker Electrochemical Co.
Linde Air Products Company
Mathieson Alkali Works (Inc.), The
29. GLASS (Window, Plate, Table)
American Window Glass Co.
Corning Glass Works
Fry, H. C., Glass Company
30. GRAPHITE, CARBON and Their Products
Acheson Graphite Company
National Carbon Company, Inc.
31. HAIR (Curled, etc.)
Armour Curled Hair Works
32. INK (Printing and Writing; Ribbons)
Ault & Wiborg Company, The
Eagle Printing Ink Co., The
Morrill, Geo. H., Co.
Northwestern Chemical Co., The
33. INSULATED WIRE (Cable, Cordage and Accessories)
Belden Manufacturing Company
34. INSULATION (Electrical and Thermal)
Boonton Rubber Manufacturing Company
Champion Ignition Co.
Condensite Company of America
General Bakelite Company
Redmanol Chemical Products Co.


35. IRON (Wrought and Cast; Pipe)
American Rolling Mill Co., The
Byers, A. M., Company
Electro-Metallurgical Company
Metal & Thermit Corporation
National Tube Company
36. LABORATORIES (Commercial,
Research, Testing, etc.)
Babcock Testing Laboratory
Beckman and Linden Engineering
Corporation
Bennetts' Chemical Laboratory
Boston Bio-Chemical Laboratory,
(Inc.), The
Case Research Laboratory
Charlotte Chemical Laboratories,
Inc.
Cleveland Testing Laboratory Co.,
The
Detroit Testing Laboratory, The
Dorr Company, The
Edison, Thomas A., Laboratory
Electrical Testing Laboratories
Ellis, Carleton, Laboratories
Emerson Laboratory
FitzGerald Laboratories, Inc., The
Gray Industrial Laboratories, The
Heinrich Laboratories of Applied
Chemistry
Hochstadter Laboratories
Howard Wheat and Flour Testing
Laboratory, The
Industrial Research Corporation
Industrial Research Laboratories
Industrial Testing Laboratories
Industrial Works
Institute of Industrial Research,
The
Kalmus, Comstock & Westcott,
Inc.
Kiddle, Walter, & Company, In-
corporated
Kraus Research Laboratories, Inc.
Lederle Laboratories
Lincoln, E. S., Inc.
Little, Arthur D., Inc.
Littlefield Laboratories Co.
Lockhart Laboratories
Maynard, T. Poole
Mellon Institute of Industrial
Research
- Metz, H. A., Laboratories, Inc.
Nichols Laboratories, The
Nowak Chemical Laboratories
Page, Carl M.
Pittsburgh Testing Laboratory
Schwarz Laboratories
Souther, Henry, Engineering Co.,
The
Squibb, E. R., & Sons
U. S. Conditioning and Testing
Co.
37. LABORATORY SUPPLIES
Eimer & Amend
38. LEAD
See Zinc
39. LEATHER AND LEATHER
GOODS (Tanning, etc.; substi-
tutes)
American Leather Research Lab-
oratory
Gallun, A. F., & Sons Co.
Kistler, Lesh & Company
Kullman, Salz & Co.
Pantasote Leather Company, The
Pfister & Vogel Leather Co.
40. LUBRICANTS Grease, Graphite,
Oil)
Acheson Graphite Company
Standard Oil Company
Vacuum Oil Company
41. MACHINE TOOLS
Brown & Sharpe Mfg. Co.
Industrial Research Corporation
United Shoe Machinery Corpora-
tion
42. MATCHES
Diamond Match Co., The
43. NON-FERROUS METALS, Mis-
cellaneous
Aluminum Castings Co., The
American Vanadium Company
Doehler Die-Casting Co.
Guggenheim Bros.
Hoskins Manufacturing Company
International Nickel Co., The
International Silver Company
Metal & Thermit Corporation
Titanium Alloy Manufacturing
Company, The

44. **OPTICAL GOODS**
American Optical Company
Bausch & Lomb Optical Co.
Corning Glass Works
Spencer Lens Company
45. **PAINTS, OILS, VARNISHES, LACQUERS**
Berry Bros., Inc.
Cabot, Samuel, Inc.
Condensite Company of America
du Pont, E. I., de Nemours & Co.
Glidden Company, The
Krebs Pigment and Chemical Co.,
National Lead Company
Newport Turpentine & Rosin
Company of Florida
Patton Paint Company
Redmanol Chemical Products Co.
Toch Brothers
46. **PAPER AND PULP**
American Writing Paper Co.
Brown Company (formerly Berlin Mills Company)
Crane & Co.
Cumberland Mills (S. D. Warren & Co.)
Dill & Collins Co.
du Pont, E. I., de Nemours & Company
Eastern Manufacturing Company
Hamersley M'f'g Co.
Remington Arms, United Metallic
Cartridge Company
Strathmore Paper Company
Weston, Byron, Co.
47. **PETROLEUM AND ITS PRODUCTS**
Atlantic Refining Company, The
Cosden & Company
Ellis, Carleton, Laboratories
Empire Companies, The
Empire Gasoline Company
Gray Industrial Laboratories, The
Gulf Pipe Line Company
Martinez Refinery, Shell Co. of
California
Standard Oil Company
Vacuum Oil Company
48. **PHARMACEUTICAL PREPARATIONS (Drugs, Patent Medicines, etc.)**
American Research Fund
Cudahy Packing Company, The
Kolynos Co., The
Lilly, Eli, and Company
Merck & Co.
Parke, Davis & Company
Squibb, E. R., & Sons
United Drug Co.
Upjohn Company, The
Warner, William R., & Company,
Incorporated
Zinsser & Co.
49. **PHONOGRAPHS AND GRAPHOPHONES**
Columbia Graphophone Manufacturing Company
Edison, Thomas A., Laboratory
50. **PHOTOGRAPHIC EQUIPMENT (Cameras, Films, Plates, etc.)**
Anso Company
Eastman Kodak Company
51. **PIPE (Iron and Steel) and FITTINGS**
Byers, A. M., Company
Crane Co.
Lunkenheimer Co., The
National Tube Company
52. **PLASTICS**
Columbia Graphophone Manufacturing Company
Condensite Company of America
du Pont, E. I., de Nemours & Company
General Bakelite Company
Redmanol Chemical Products Co.
53. **PUBLIC UTILITIES**
Stone & Webster
Westinghouse Church Kerr & Co., Incorporated
54. **RADIO EQUIPMENT (Wireless, Telegraph, Telephone)**
American Radio and Research Corporation
Kilbourne & Clark Manufacturing Company
55. **RAILROADS**
Pennsylvania Railroad Company, The

56. RAILROAD EQUIPMENT (other than Rolling-Stock)
Union Switch & Signal Company
57. RAILROAD ROLLING-STOCK (Cars, Locomotives and Accessories)
Baldwin Locomotive Works, The
58. RUBBER AND RUBBER GOODS and Substitutes
Boonton Rubber Manufacturing Company
Brunswick-Balke-Collender Co., The
Condensite Company of America
Falls Rubber Company, The
Firestone Tire & Rubber Company
Fisk Rubber Company, The
General Bakelite Company
General Tire & Rubber Co.
Goodrich, B. F., Company, The
Goodyear Tire & Rubber Company, The
Hood Rubber Company
Manhattan Rubber Mfg. Co., The
Miller Rubber Co., The
Portage Rubber Co., The
Rubber Trade Laboratory
59. SANITATION, SANITARY EQUIPMENT AND SUPPLIES
Lederle Laboratories
Souther, Henry, Engineering Co., The
Weston & Sampson
60. SHIPBUILDING
Bethlehem Shipbuilding Corporation, Ltd.
Cramp, William & Sons Ship & Engine Building Co., The
61. SOAP
Armour Soap Works
Globe Soap Co.
Larkin Co.
62. STEAM BOILERS AND ACCESSORIES
Babcock & Wilcox Co., The
Dearborn Chemical Company
Harrison Safety Boiler Works
63. STEEL MILLS
Carnegie Steel Company
Inland Steel Company
Kokomo Steel and Wire Co.
Ludlum Steel Company
Midvale Steel Company, The
Minneapolis Steel and Machinery Co.
United Alloy Steel Corporation
64. SUGAR
American Beet Sugar Company
American Sugar Refining Company, The
Arbuckle Brothers
Great Western Sugar Company, The
Spreckels Sugar Company
Western Sugar Refinery
65. TAR and Its Products
Barrett Company, The
Cabot, Samuel, Inc.
66. TEXTILES AND CLOTHING
Amoskeag Manufacturing Company
Arlington Mills
Art in Buttons
Stevens, M. T., & Sons Co.
U. S. Conditioning and Testing Co.
67. TIN PLATE
American Can Company
American Sheet and Tin Plate Co.
68. WATER TREATMENT
Permutit Company, The
Weston & Sampson
69. WELDING (Electric, Forge, Gas)
Davis-Bournonville Company
Metal & Thermit Corporation
70. WIRE
Kokomo Steel and Wire Co.
71. WOOD and its Products
Florida Wood Products Co.
72. ZINC AND LEAD
American Zinc, Lead and Smelting Company
National Lead Company
New Jersey Zinc Company, The
Stone & Webster
Western Precipitation Company

Cross-references

Subject	See No.	Subject	See No.
Acids (bulk).....	15	Gum.....	2
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Baking powder.....	25	Lead.....	72
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